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1959-1960

Vol. 12

January 8, 1959

No. 12

Graduate School Announcements at College Park

A Publication of the University of Maryland

The provisions of this publication are not to be regarded as an irrevocable contract between the student and the University of Maryland. The University reserves the right to change any provision or requirement at any time within the student's term of residence. The University further reserves the right at any time, to ask a student to withdraw when it considers such action to be in the best interests of the University.

GRADUATE SCHOOL ANNOUNCEMENTS

Catalog Series 1959-1960



UNIVERSITY OF MARYLAND

VOLUME 12

JANUARY 8, 1959

NO. 12

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UNIVERSITY CALENDAR

FALL SEMESTER 1958

JANUARY 1959

- 5 Monday—Christmas Recess Ends 8 a.m.
- 21 Wednesday—Pre-Examination Study Day
- 22-28 Thursday to Wednesday—First Semester Examinations

SPRING SEMESTER 1959

FEBRUARY

- 2-6 Monday to Friday—Spring Semester Registration
- 9 Monday—Instruction Begins
- 23 Monday—Washington's Birthday Holiday

MARCH

- 25 Wednesday—Maryland Day
- 26 Thursday—Easter Recess Begins After Last Class
- 31 Tuesday—Easter Recess Ends 8 a.m.

MAY

- 13 Wednesday—Military Day
- 28 Thursday—Pre-Examination Study Day
- May 29- } Friday to Friday—Second Semester Examinations
- June 5 }
- 30 Memorial Day, Holiday

JUNE

- 6 Saturday—Commencement Exercises
- ## SUMMER SESSION 1959

JUNE 1959

- 22 Monday—Summer Session Registration
- 23 Tuesday—Summer Session Begins

JULY

- 31 Friday—Summer Session Ends
- ## SHORT COURSES 1959

JUNE 1959

- 15-20 Monday to Saturday—Rural Women's Short Course

AUGUST

- 3-8 Monday to Saturday—4-H Club Week

SEPTEMBER

- 8-11 Tuesday to Friday—Firemen's Short Course
- ## FALL SEMESTER 1959

SEPTEMBER

- 14-18 Monday to Friday—Fall Semester Registration
- 21 Monday—Instruction Begins

NOVEMBER

- 25 Wednesday—Thanksgiving Recess Begins After Last Class
- 30 Monday—Thanksgiving Recess Ends 8 a.m.

DECEMBER

- 19 Saturday—Christmas Recess Begins After Last Class

JANUARY 1960

- 4 Monday—Christmas Recess Ends 8 a.m.
- 20 Wednesday—Pre-Examination Study Day
- 21-27 Thursday to Wednesday, inclusive—Fall Semester Examinations

UNIVERSITY CALENDAR

SPRING SEMESTER 1960

FEBRUARY

- 1-5 Monday to Friday—Spring Semester Registration
- 8 Monday—Instruction Begins
- 22 Monday—Washington's Birthday Holiday

MARCH

- 25 Friday—Maryland Day

APRIL

- 14 Thursday—Easter Recess Begins After Last Class
- 19 Tuesday—Easter Recess Ends 8 a.m.

MAY

- 18 Wednesday—Military Day
- 26 Thursday—Pre-Examination Study Day
- May 27- }
June 3 } Friday to Friday, inclusive—Spring Semester Examinations
- 29 Sunday—Baccalaureate Exercises
- 30 Monday—Memorial Day, Holiday

JUNE

- 4 Saturday—Commencement Exercises

SUMMER SESSION 1960

JUNE 1960

- 20 Monday—Summer Session Registration
- 21 Tuesday—Summer Session Begins

SHORT COURSES 1960

JUNE 1960

- 13-18 Monday to Saturday—Rural Women's Short Course

AUGUST

- 1-6 Monday to Saturday—4-H Club Week

SEPTEMBER

- 6-9 Tuesday to Friday—Firemen's Short Course

GRADUATE SCHOOL SUPPLEMENT TO GENERAL CALENDAR

1959

October 2FridayLast day to file applications for admission to candidacy for Doctor's degrees on June 4, 1960 and Master's degrees on January 27, 1960.

October 6TuesdayModern language examination for Ph.D. requirement.

December 2WednesdayLast day to file applications for diplomas at the office of the Registrar for degrees on January 27, 1960. .

1960

January 6WednesdayLast day to deposit theses in the office of the Graduate School for students completing requirements for degrees on January 27, 1960.

February 9TuesdayModern language examination for Ph.D. requirement.

February 12FridayLast day to file applications for admission to candidacy for Master's degrees on June 4, 1960.

April 8FridayLast day to file applications for diplomas at the office of the Registrar for degrees June 4, 1960.

May 13FridayLast day to deposit theses in the office of the Graduate School for students completing requirements for degrees on June 4, 1960.

June 7TuesdayModern language examination for Ph.D. requirement.

June 6MondayLast day to file applications for admission to candidacy at June meeting of the Graduate Council.

July 1FridayLast day to file applications for diplomas at the office of the Registrar for degrees on July 29, 1960.

July 15FridayLast day to deposit theses in the office of the Graduate School for students completing requirements for degrees on July 29, 1960.

BOARD OF REGENTS

and

MARYLAND STATE BOARD OF AGRICULTURE

	<i>Term Expires</i>
CHARLES P. McCORMICK <i>Chairman</i> McCormick and Company, 414 Light Street, Baltimore 2	1966
EDWARD F. HOLTER <i>Vice-Chairman</i> The National Grange, 744 Jackson Place, N.W., Washington 6	1959
B. HERBERT BROWN <i>Secretary</i> The Baltimore Institute, 12 West Madison Street, Baltimore 1	1960
HARRY H. NUTTLE <i>Treasurer</i> Denton	1966
LOUIS L. KAPLAN <i>Assistant Secretary</i> 5800 Park Heights Avenue, Baltimore 15	1961
EDMUND S. BURKE <i>Assistant Treasurer</i> Kelly-Springfield Tire Company, Cumberland	1959
ALVIN L. AUBINOE 1515 Nineteenth Street, N.W., Washington 6, D. C.	1967
THOMAS W. PANGBORN The Pangborn Corporation, Pangborn Blvd., Hagerstown	1965
ENOS S. STOCKBRIDGE 10 Light Street, Baltimore 2	1960
THOMAS B. SYMONS Suburban Trust Company, 6950 Carroll Avenue, Takoma Park	1963
C. EWING TUTTLE 907 Latrobe Building, Charles and Read Streets, Baltimore 2	1962

Members of the Board are appointed by the Governor of the State for terms of nine years each, beginning the first Monday in June.

The President of the University of Maryland is, by law, Executive Officer of the Board.

The State law provides that the Board of Regents of the University of Maryland shall constitute the Maryland State Board of Agriculture.

OFFICERS OF ADMINISTRATION

Principal Administrative Officers

WILSON H. ELKINS, *President*

B.A., University of Texas, 1932; M.A., 1932; B.LITT., Oxford University, 1936;
D.PHIL., 1936.

ALBIN O. KUHN, *Executive Vice President*

B.S., University of Maryland, 1938; M.S., 1939; PH.D., 1948.

ALVIN E. CORMENY, *Assistant to the President, in Charge of Endowment and Development*

B.A., Illinois College, 1933; LL.B., Cornell University, 1936.

R. LEE HORNBAKE, *Dean of the Faculty*

B.S., State Teachers College, California, Pa., 1934; M.A., Ohio State University, 1936;
PH.D., 1942.

FRANK L. BENTZ, JR., *Assistant, President's Office*

B.S., University of Maryland, 1942; PH.D., 1952.

Emeriti

HARRY C. BYRD, *President Emeritus*

B.S., University of Maryland, 1908; LL.D., Washington College, 1936; LL.D., Dickinson College, 1938; D.SC., Western Maryland College, 1938.

HAROLD F. COTTERMAN, *Dean of the Faculty, Emeritus*

B.S., Ohio State University, 1916; M.A., Columbia University, 1917; PH.D., American University, 1930.

Administrative Officers of the Schools and Colleges

MYRON S. AISENBERG, *Dean of the School of Dentistry*

D.D.S., University of Maryland, 1922.

VERNON E. ANDERSON, *Dean of the College of Education*

B.S., University of Minnesota, 1930; M.A., 1936; PH.D., University of Colorado, 1942.

RONALD BAMFORD, *Dean of the Graduate School*

B.S., University of Connecticut, 1924; M.S., University of Vermont, 1926; PH.D., Columbia University, 1931.

GORDON M. CAIRNS, *Dean of Agriculture*

B.S., Cornell University, 1936; M.S., 1938; PH.D., 1940.

RAY W. EHRENSBERGER, *Dean of the College of Special and Continuation Studies*

B.A., Wabash College, 1929; M.A., Butler University, 1930; PH.D., Syracuse University, 1937.

NOEL E. FOSS, *Dean of the School of Pharmacy*

PH.C., South Dakota State College, 1929; B.S., 1929; M.S., University of Maryland, 1932; PH.D., 1933.

LESTER M. FRALEY, *Dean of the College of Physical Education, Recreation, and Health*

B.A., Randolph-Macon College, 1928; M.A., 1937; PH.D., Peabody College, 1939.

FLORENCE M. GIPE, *Dean of the School of Nursing*

B.S., Catholic University of America, 1937; M.S., University of Pennsylvania, 1940; ED.D., University of Maryland, 1952.

LADISLAUS F. GRAPSKI, *Director of the University Hospital*

R.N., Mills School of Nursing, Bellevue Hospital, New York, 1938; B.S., University of Denver, 1942; M.B.A. in Hospital Administration, University of Chicago, 1943.

IRVIN C. HAUT, *Director, Agricultural Experiment Station and Head, Department of Horticulture*

B.S., University of Idaho, 1928; M.S., State College of Washington, 1930; PH.D., University of Maryland, 1933.

ROGER HOWELL, *Dean of the School of Law*

B.A., Johns Hopkins University, 1914; PH.D., 1917; LL.B., University of Maryland, 1917.

WILBERT J. HUFF, *Director, Engineering Experiment Station*

B.A., Ohio Northern University, 1911; B.A., Yale College, 1914; PH.D., Yale University, 1917; D.Sc. (HON.), Ohio Northern University, 1927.

SELMA F. LIPPEATT, *Dean of the College of Home Economics*

B.S., Arkansas State Teachers College, 1938; M.S., University of Tennessee, 1945; PH.D., Pennsylvania State University, 1953.

FREDERIC T. MAVIS, *Dean of the College of Engineering*

B.S., University of Illinois, 1922; M.S., 1926; PH.D., 1935.

PAUL E. NYSTROM, *Director, Agricultural Extension Service*

B.S., University of California, 1928; M.S., University of Maryland, 1931; M.P.A., Harvard University, 1948; D.P.A., 1951.

J. FREEMAN PYLE, *Dean of the College of Business and Public Administration*

PH.B., University of Chicago, 1917; M.A., 1918; PH.D., 1925.

LEON P. SMITH, *Dean of the College of Arts and Sciences*

B.A., Emory University, 1919; M.A., University of Chicago, 1928; PH.D., 1930; Diplome le l'Institut de Touraine, 1932.

WILLIAM S. STONE, *Dean of the School of Medicine and Director of Medical Education and Research*

B.S., University of Idaho, 1924; M.S., 1925; M.D., University of Louisville, 1929; PH.D., (HON.), University of Louisville, 1946.

General Administrative Officers

G. WATSON ALGIRE, *Director of Admissions and Registrations*

B.A., University of Maryland, 1930; M.S., 1931.

NORMA J. AZLEIN, *Registrar*

B.A., University of Chicago, 1940.

- B. JAMES BORRESON, *Executive Dean for Student Life*
B.A., University of Minnesota, 1944.
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B.A., University of Maryland, 1938.
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B.A., University of Maryland, 1932; M.A., 1934; C.P.A., 1939.
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B.S., University of Iowa, 1936; M.D., University of Iowa, 1926.
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A.B., William and Mary College, 1939.
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B.A., University of Massachusetts, 1941.
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B.S., University of Maryland, 1927; E.E., 1931.
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B.A., University of Illinois, 1936; M.A., 1937; B.S.L.S., Columbia University, 1940.
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B.A., Tulane University, 1921; M.A., University of Maryland, 1924.
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B.S., University of Maryland, 1933.

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- JOHN E. FABER, JR., *Chairman of the Division of Biological Sciences*
B.S., University of Maryland, 1926; M.S., 1927; PH.D., 1937.
- HAROLD C. HOFFSOMMER, *Chairman of the Division of Physical Sciences*
B.S., Northwestern University, 1921; M.A., 1923; PH.D., Cornell University, 1929.
- WILBERT J. HUFF, *Chairman of the Division of Physical Sciences*
B.A., Ohio Northern University, 1911; B.A., Yale College, 1914; PH.D., Yale University, 1917; D.SC., (HON.), Ohio Northern University, 1927.
- CHARLES E. WHITE, *Chairman of the Lower Division*
B.S., University of Maryland, 1926; M.S., 1927; PH.D., 1937.
- ADOLF E. ZUCKER, *Chairman of the Division of Humanities*
B.A., University of Illinois, 1912; M.A., 1913; PH.D., University of Pennsylvania, 1917.

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Dr. Charles White (Arts and Sciences), *Chairman*

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COMMITTEE ON MEMBERSHIP AND REPRESENTATION

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THE GRADUATE SCHOOL

THE GRADUATE SCHOOL WAS ESTABLISHED IN ITS PRESENT FORM IN 1918 under the jurisdiction of the Graduate Council with the Dean of the Graduate School serving as Chairman. It was created for the purpose of administering and developing programs of advanced study and research for graduate students in all branches of the University. Prior to the present organization some advanced degrees were awarded but they were under the jurisdiction of the individual departments subject to the supervision of the general faculty. Despite the large expansion of graduate programs into new areas as the University has grown, the spirit of each program is essentially that of individual study under competent supervision. The Graduate School is not an extension of the undergraduate program but was created rather for the preparation of those who in the future will carry on the spirit of individual inquiry. Thus it promotes and provides an atmosphere of research and scholarship for both the students and the faculty; in particular, it stimulates that harmonious relationship between the two which results in the advancement of learning. At the present time over fifty departments are authorized to offer graduate programs leading to one or more of the advanced degrees awarded by the University.

The Graduate Council consists of ex-officio, elected and appointed members of the Graduate Faculty and is charged with the formulation of the overall policies of the Graduate School. It meets regularly in March, June and November to consider all matters relating to graduate work brought to its attention by the University Administration, the Graduate Faculty and the Dean of the Graduate School. It may also be called for special meetings throughout the year if urgent business must be transacted.

The Graduate Faculty consists of regular and associate members chosen in accordance with the Plan of Organization of the Graduate Faculty and is listed in the back of this catalog. The direction of individual programs and theses is primarily assigned to the regular members of the Graduate Faculty.

The Graduate Faculty Assembly consists of the regular members of the Graduate Faculty and meets once each year. Special meetings may be called by the Dean of the Graduate School if necessary. In accordance with the University Faculty Organization Plan, it has authority over the educational policy of the Graduate School, may review actions taken by the Graduate Council and serves as a referendum body on questions referred to it by the Graduate Council.

The Dean of the Graduate School serves as chairman and executive officer of both the Graduate Council and the Graduate Faculty Assembly.

The following standing committees are appointed by the Dean of the Graduate School: The Committee on Publications, Committee on Language Requirements, Committee on Graduate Programs and Standards for Graduate

General Information

Work, Committee on Fellowships and Student Welfare, Committee on Research, Committee on Procedures, Committee on the Graduate Faculty, and the Committee on Elections. They report annually to the Graduate Council and reports may be requested by the Dean of the Graduate School or by the Graduate Faculty Assembly.

LOCATION

The office of the Graduate School is located on the second floor of the Skinner Building on the College Park campus. This campus is located in Prince Georges County on a large tract of rolling wooded land less than eight miles from Washington, D. C. and approximately thirty-two miles from Baltimore and is served by excellent transportation.

The Baltimore campus of the University is located at the corner of Lombard and Greene Streets, and on this campus the various departments in the Schools of Medicine, Dentistry, Pharmacy and Nursing offer their graduate programs.

LIBRARIES

The libraries of the University are located on both the College Park and Baltimore campuses. They consist of the general University Library and the many college and departmental libraries which house special collections. Because of the location of the University the large libraries of Baltimore and Washington are a valuable asset to graduate work. Arrangements can be made for personal work in the Enoch Pratt Library of Baltimore, the Library of Congress, the United States Department of Agriculture Library and the many fine collections of other government agencies in Washington.

GENERAL INFORMATION

Detailed information concerning fees and expenses, scholarships and awards, student life, and other material of a general nature, may be found in the University publication titled *An Adventure in Learning*. This publication may be obtained on request from the Office of University Relations, North Administration Building, University of Maryland at College Park. A detailed explanation of the regulations of student and academic life, may be found in the University publication titled, *University General and Academic Regulations*. This is mailed in September of each year to all undergraduate students, and again in February to all new undergraduate students not previously enrolled in the preceding fall semester.

Requests for course catalogs for the individual schools and colleges should be directed to the deans of these respective units, addressed to:

COLLEGES LOCATED AT COLLEGE PARK:

Dean
(College in which you are interested)
The University of Maryland
College Park, Maryland

PROFESSIONAL SCHOOLS LOCATED AT BALTIMORE:

Dean
(School in which you are interested)
The University of Maryland
Lombard and Greene Streets
Baltimore 1, Maryland

Academic Information

ADMISSION

An applicant for admission to the Graduate School must hold a Bachelor's or a Master's degree from a college or university of recognized standing. The applicant shall furnish an official transcript of his collegiate record which for unconditional admission must show creditable completion of an adequate amount of undergraduate preparation of high quality for graduate work in his chosen field. Application for admission to the Graduate School should be made not later than September 1 for the fall term and not later than January 1 for the spring term on blanks obtained from the office of the Dean. Admission to the Summer Session is governed by the date listed in the Summer School bulletin, which is generally soon after June 1.

After approval of the application a matriculation card, signed by the Dean, is issued to the student. This card permits him to register in the Graduate School. It is his certificate of membership in the Graduate School and should be retained by the student to present at each succeeding registration.

Admission to the Graduate School does not necessarily imply admission to candidacy for an advanced degree.

REGISTRATION

All students pursuing graduate work in the University, even though they are not candidates for higher degrees, are required to register in the Graduate School at the beginning of each session. *Graduate credit will not be given unless the student matriculates and registers in the Graduate School.* This applies especially to those students who register through the College of Special and Continuation Studies at locations away from the campus.

The program of work for each session is arranged by the student with the major department and entered upon two course cards which are signed first by the professor in charge of the student's major subject and then by the Dean of the Graduate School. One card is retained by the Dean. The student takes the other card, and his matriculation card, to the Registrar's Office, where the registration is completed. Students will not be admitted to graduate courses until the Registrar has certified to the instructor that registration has been completed. Registration forms are obtained at the Registrar's Office.

A time schedule, supplementing this catalog, is issued shortly before the beginning of each semester, showing the hours and location of class meetings. This schedule is available at the Office of the Registrar.

Academic Information

GRADUATE COURSES

Graduate students must elect for credit in partial fulfillment of the requirements for higher degrees only courses designated *For Graduates* or *For Graduates and Advanced Undergraduates*. Students who are inadequately prepared for graduate work in their chosen fields or who lack prerequisites for minor courses may elect a limited number of courses numbered from 1 to 99 in the general catalog, but graduate credit will not be allowed for these courses. Courses that are audited are registered for in the same way as other courses, and the fees are the same.

PROGRAM OF WORK

The professor who is selected to direct a student's thesis work is the student's advisor in the formulation of a graduate program, including suitable minor work, which is arranged in cooperation with the instructors. To encourage thoroughness in scholarship through intensive application, graduate students in the regular sessions are limited to a program of fifteen credit hours per semester. If a student is preparing a thesis during the minimum residence for the Master's degree, the registration in graduate courses should not exceed twelve hours for the semester since registration in research is required.

SUMMER SESSION

The University conducts a six-weeks summer session at College Park, with a comprehensive undergraduate and graduate program. The University publishes a separate bulletin giving full information on this summer session. This bulletin is available upon application to the Director of the Summer School, University of Maryland, College Park.

GRADUATE WORK IN PROFESSIONAL SCHOOLS AT BALTIMORE

Graduate courses and opportunities for research are offered in the professional schools at Baltimore. Students pursuing graduate work in the professional schools must register in the Graduate School and meet the same requirements and proceed in the same way as do graduate students in the other departments of the University.

OAK RIDGE INSTITUTE

The University is one of the sponsoring institutions of the Oak Ridge Institute of Nuclear Studies located at Oak Ridge, Tennessee. One of the features of this affiliation is the opportunity, in the appropriate fields, for graduate students to do their research problems and prepare their theses under a cooperative arrangement. Such opportunity is limited to those who have completed their course work on the campus, are working in a field where facilities are available, and generally are candidates for the doctoral degree. Successful applicants will re-

ceive Oak Ridge Graduate Fellowships with varying stipends depending upon their marital status and dependents. Detailed information can be obtained from the Graduate School office or from Dr. N. L. Drake, Department of Chemistry, Councilor for the University.

FOREIGN STUDENTS

Graduate students from foreign countries where English is not the native tongue should be adequately prepared to read and write in this language. Admission to graduate study implies that the student is aware of this requirement and is prepared to fully participate in the course of study and research work that is assigned. A foreign student advisor is available to all graduate students from other countries to discuss matters of immigration.

Since the admission and stay of foreign students are in part dependent on regulations issued by the United States Immigration and Naturalization Service, it is advisable for all graduate students who have been admitted to the Graduate School to consult the Foreign Student Advisor in regard to their immigration status. Students wishing to come to the United States with a student visa must secure an Immigration I-20 Form from the Dean of the Graduate School in order to secure the proper visa from the American consul. Students with student visas already studying in the United States who wish to transfer to the University of Maryland must also secure an I-20 Form from the Dean of the Graduate School in order to request the Immigration and Naturalization Service to grant permission for the transfer.

Every foreign student is expected to see the Foreign Student Advisor as soon as possible after arriving at the University. The Advisor will be able to assist not only with various problems regarding immigration, housing, fees, etc., but also with more general problems of orientation to life in the University and the community.

GRADUATE WORK BY SENIORS IN THIS UNIVERSITY

A senior of this University who has nearly completed the requirements for the undergraduate degree may, with the approval of his undergraduate dean, the head of the department concerned, and the Dean of the Graduate School, register in the undergraduate college for graduate courses, which may later be transferred for graduate credit toward an advanced degree at this University, but the student must be within seven credit hours of completing his undergraduate work and the total of undergraduate and graduate courses must not exceed fifteen credits for the semester. Excess credits in the senior year cannot later be used for graduate credit unless such pre-arrangement is made. Seniors who wish to register for graduate credit should apply to the Dean of the Graduate School for information about procedure.

ADMISSION TO CANDIDACY FOR ADVANCED DEGREES

Application for admission to candidacy for the Master's and for the Doctor's degree is made on application blanks which are obtained at the office of the Dean of the Graduate School. These are filled out in duplicate by the student and submitted to his major department for further action and transmission to the Dean of the Graduate School. All applications for admission to candidacy must be approved by the Graduate Council.

Admission to candidacy in no case assures the student of a degree, but merely signifies he has met all the formal requirements and is considered by his instructors sufficiently prepared and able to pursue such graduate study and research as are demanded by the requirements of the degree sought. The candidate must show superior scholarship in graduate work already completed.

Application for admission to candidacy is made at the time stated in the sections dealing with the requirements for the degree sought.

REQUIREMENTS FOR THE DEGREES OF MASTER OF ARTS AND MASTER OF SCIENCE

ADVANCEMENT TO CANDIDACY. Each prospective candidate for the Master's degree is required to make application for admission to candidacy not later than the date on the calendar for the semester in which the degree is sought. (See Graduate School Supplement to the General Calendar in the front of this Catalog.) He must have completed at least twelve semester hours of graduate work at the University of Maryland. An average grade of "B" in all major and minor subjects is the minimum requirement. Courses completed with a "D" or "F" in the major and minor must be repeated.

MINIMUM RESIDENCE. A residence of at least two semesters, or equivalent, at this institution, is required.

COURSE REQUIREMENTS. A minimum of twenty-four semester hours, exclusive of thesis and registration for research, with a minimum average grade of "B" in courses approved for graduate credit, is required for the degrees of Master of Arts and Master of Science. The student is also required to register for six semester hours for research and thesis work. The total number of credit hours required for the degree is thirty. If the student is inadequately prepared for the required graduate courses, either in the major or minor subjects, additional courses may be required to supplement the undergraduate work. Of the twenty-four hours required in graduate courses, not less than twelve and not more than sixteen semester hours must be earned in the major subject. The remaining credits must be outside the major subject and must comprise a group of coherent courses intended to supplement and support the major work. Not less than one-half of the total required course credits for the degree, or a minimum of twelve, must be selected from courses numbered 200 or above. No credit for the degree of Master of Arts or Master of Science may be obtained for correspondence courses

or those taken by examination. The entire course of study must constitute a unified program approved by the student's major advisor and by the Dean of the Graduate School. All requirements for the degree must be completed within an eight-year period.

TRANSFER OF CREDIT. Credit not to exceed six semester hours for course work at other recognized institutions may be applied towards the Master's degree only when such course work has been taken after the student has been admitted to the University of Maryland Graduate School. Before taking course work for transfer, the student must have the approval of his advisor and the head of the department in his major field. Normally, approval may be given only for courses which are not offered by the University of Maryland during the period of the student's attendance. The request for transfer of credit shall be submitted to the Graduate Council for approval when the student applies for admission to candidacy. The candidate is subject to final examination by this institution in all work offered for the degree.

If a graduate student working for an advanced degree at another institution wishes to take courses at the University of Maryland, his application for admission must be accompanied by a letter from the graduate dean of his institution stating that credit for such courses is acceptable toward his degree.

THESIS. In addition to the twenty-four semester hours in graduate courses, a satisfactory thesis is required of all candidates for the degrees of Master of Arts and Master of Science. (Exceptions may be made in the cases of candidates for the degree of Master of Arts in American Civilization. See page 8-9). The thesis must demonstrate the student's ability to do independent work and it must be acceptable in literary style and composition. With the approval of the student's major professor and the Dean of the Graduate School, the thesis in certain cases may be prepared *in absentia* under direction and supervision of a member of the faculty of this institution.

The original copy of the thesis must be deposited in the office of the Graduate School not later than the date specified in the calendar in the front of this catalog. The date published is the deadline for the acceptance of theses but they may be deposited earlier. The thesis should not be bound by the student, as the University later binds all theses uniformly. An abstract of the contents of the thesis, not to exceed 250 words in length, must accompany it. A manual giving full directions for the physical make-up of the thesis should be consulted by the student before the typing of the manuscript is begun. Students may obtain copies of this manual from the Students' Supply Store at nominal cost.

FINAL EXAMINATION. The final oral examination is conducted by a committee appointed by the Dean of the Graduate School. The student's advisor acts as the chairman of the committee. The other members of the committee are persons under whom the student has taken most of his major and minor courses. The chairman and the candidate are notified of the personnel of the examining committee at least one week prior to the period set for oral examinations unless an emergency arises. The chairman of the committee selects the

exact time and place for the examination and notifies the other members of the committee and the candidate. The examination is normally conducted at the end of the semester, but upon recommendation of the student's advisor, an examining committee may be appointed by the Dean of the Graduate School at any time when all other requirements for the degree have been completed. A report of the committee is sent to the Dean as soon as possible after the examination. A special form for this purpose is supplied to the chairman of the committee and the approval must be unanimous. Such report is the basis upon which recommendation is made to the faculty that the candidate be granted the degree sought. The period for the oral examination is usually about one hour, but the time should be long enough to insure an adequate examination.

The examining committee also approves the thesis, and it is the candidate's obligation to see that each member of the committee has ample opportunity to examine a copy of the thesis prior to the date of the examination.

A student will not be admitted to final examination until all other requirements for the degree have been met. In addition to the oral examination a comprehensive written examination may be required at the option of the major department.

REQUIREMENTS FOR THE DEGREES IN AMERICAN CIVILIZATION

Studies in the American Civilization program are intended to prepare the candidate for teaching and research in American culture. The program is particularly designed for the teacher or student whose intellectual interest is not limited to a single academic department. For instance, the historian who likes literature, the literary critic who wishes to study the social background of literature, the political scientist who wishes to know more about the history of this country, and the sociologist who wants to study the roots of sociology in America, all may find the American Civilization Program the proper one for them. The four cooperating departments of English, History, Government and Politics, and Sociology offer the basic work in the program, and the student will stress the work of one of those departments when he determines his course of graduate studies. All students, however, will be expected to understand the development of American institutions and to show some proficiency in the literary, social, economic, and political history of the United States.

The study of American Civilization brings in many different fields, so a student has an unusually wide opportunity to plan a program suited to his individual need. To help him do this, a committee representing the departments whose American fields he intends to study is set up shortly after he registers. The chairman of the committee is from the department of the student's greatest interest and acts as his advisor. The committee also prepares and reads the student's comprehensive examination and reads the thesis if one is submitted.

The candidate for a degree must pass a final written examination testing his understanding of American Civilization in terms of his individual program of studies.

MASTER OF ARTS. With the approval of his advisors and committee, a candidate for the Master of Arts degree with a major in American Civilization may elect in lieu of the thesis six additional hours of course work, to include at least two substantial seminar papers. The total number of credit hours required for the degree would then be thirty semester hours.

Each candidate must present credits for at least *fifteen semester hours* of work in two of the four cooperating departments, and credits for at least fifteen semester hours in supporting courses (nine hours if a thesis is elected). Supporting courses will normally be in such fields as European or Latin-American history, English literature, comparative literature, philosophy, art, education, sociology, economics, and government and politics.

Each candidate must demonstrate in a written examination that he possesses a reading knowledge of one foreign language.

All other requirements are the same as for the degrees of Master of Arts and Master of Science in other fields.

DOCTOR OF PHILOSOPHY. The American Civilization program cuts across several fields; therefore, a faculty committee representing the departments in which the student plans to study will be appointed shortly after the student registers. The chairman of the committee is from the department of the student's major interest and acts as his advisor. The committee is responsible for helping the student to integrate his program. Working through the student's advisor, the committee aids in planning the student's over-all program, prepares and grades any comprehensive examinations, and reads the dissertation.

The general requirements for the degree of Doctor of Philosophy in American Civilization are the same as those for the doctoral degree in other fields.

REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION

The Master of Education degree is designed to increase competency in applied areas within the general field of education. Thirty semester hours of course work are required. Of the thirty hours, one-half must be in courses numbered 200 and above, and one-half must be in Education. Subject to the foregoing limitations, courses in departments other than Education may be selected by the student and his advisor.

In connection with course work there are required two seminar papers, the nature and form of which are prescribed in a Statement of Policy issued by the Department of Education.

The procedure for advancement to candidacy and the transfer of credits, is the same as for the degrees of Master of Arts and Master of Science. The nature of the comprehensive examination, and other matters pertaining to degree requirements, are described elsewhere in these announcements and in the Statement of Policy referred to above.

REQUIREMENTS FOR THE

DEGREE OF MASTER OF BUSINESS ADMINISTRATION

The Master of Business Administration program is designed primarily to train students for positions of responsibility in business and government. The aim is to develop technical competence plus a thorough knowledge and appreciation of the art of management. The study of administrative policies and practices encourages interest and realistic thinking in management problems and responsibilities.

The program leading to the degree of Master of Business Administration includes advanced study of business organization and administration in the fields of accounting and statistics, finance, general business, industrial management, insurance and real estate, marketing, personnel relations, public utilities and transportation.

Those students whose major undergraduate work has been in arts, agriculture, science, education, or engineering subjects are required to complete certain basic core course requirements in business and economics before undertaking specialized graduate work for the degree of Master of Business Administration. The core course requirements are listed below. Responsible experience of exceptional value and importance may be substituted for specific courses.

Principles of Economics.....6 hours	Marketing Management3 hours
Principles of Accounting...6 or 8 hours	Personnel Management3 hours
Statistics3 hours	Money and Banking3 hours
Business Law3 or 4 hours	

The other requirements for the degree are the same as for the degrees of Master of Arts and Master of Science.

REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

ADVANCEMENT TO CANDIDACY. Candidates for the Doctor's degree must be admitted to candidacy at least one academic year prior to the conferring of degrees. Applications for admission to candidacy for the doctor's degree are made in duplicate by the student and submitted to his major department for further action and transmission to the Dean of the Graduate School. Blanks may be obtained at the office of the Graduate School.

Before admission to candidacy the applicant must have demonstrated to the Head of the Foreign Language Department that he possesses a reading knowledge of at least two foreign languages from the list approved by his major department, one of which must be either French or German. Preliminary examinations or such other substantial tests as the departments may elect are also required for admission to candidacy.

The student must complete all of his program for the degree, including the thesis and final examination, during a four-year period after admission to candidacy. Failure to do so requires another application for admission to candidacy with the usual preliminary examination unless the Graduate Council rules otherwise.

RESIDENCE. The equivalent of three years of full-time graduate study and research is the minimum required. Of the three years the equivalent of at least one year must be spent in residence at the University. On a part-time basis the time needed will be correspondingly increased. All work at other institutions offered in partial fulfillment of the requirements for the Doctor of Philosophy degree is submitted to the Graduate Council for approval, upon recommendation of the department concerned, when the student applies for admission to candidacy for the degree.

The Doctor's degree is not given merely as a certificate of residence and work, but is granted only upon sufficient evidence of high attainments in scholarship, and ability to carry on independent research in the special field in which the major work is done.

MAJOR AND MINOR SUBJECTS. The candidate must select a major and one or two closely related minor subjects. At least twenty-four semester hours of course work, exclusive of research, are required in the minor. Of the twenty-four semester hours at least eight hours must be at the 200-level unless special permission is granted beforehand. If two areas are chosen for the minor requirement not less than nine semester credit hours may be presented in either area. The remainder of the required residence is devoted to intensive study and research in the major field. The amount of required course work in the major subject will vary with the department and the individual candidate. The candidate must register for a minimum of twelve semester hours of research.

THESIS. The ability to do independent research must be shown by a dissertation on some topic connected with the major subject. An original typewritten copy and one clear, plain carbon copy of the thesis, together with an abstract of the contents, not to exceed 600 words in length, must be deposited in the office of the Dean not later than the date specified in the calendar in the front of this catalog. The date published is the deadline for the acceptance of theses but they may be deposited earlier. It is the responsibility of the student also to provide copies of the thesis for the use of the members of the examining committee prior to the date of the final examination.

The original copy should not be bound by the student, as the University later binds uniformly all theses for the general University Library. The carbon copies are bound by the student in cardboard covers which may be obtained at the Students' Supply Store. The abstracts are published by University Microfilms.

A manual giving full directions for the physical make-up of the thesis should be consulted by the student before typing of the thesis is begun. Students may obtain copies of this manual at the Students' Supply Store.

FINAL EXAMINATION. The final oral examination is held before a committee appointed by the Dean. One member of this committee is a representative of the graduate faculty who is not directly concerned with the student's gradu-

Academic Information

ate work. One or more members of the committee may be persons from other institutions who are distinguished scholars in the student's major field.

The duration of the examination is approximately three hours, and covers the research work of the candidate as embodied in his thesis, and his attainments in the fields of his major and minor subjects. The other detailed procedures are the same as those stated for the Master's examination.

RULES GOVERNING LANGUAGE EXAMINATIONS FOR CANDIDATES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

1. A candidate for the Doctor's degree must show in a written examination that he possesses a reading knowledge of French and German or such languages as approved by the major department and the Graduate Council. *The passages to be translated will be taken from books and journals approved by the student's major department. The Foreign Language Department will select material amounting to approximately 500 words from the literature submitted and present to the students in each field a common examination in mimeographed form.* The examination aims to test ability to use the foreign language so that the student may be able to read some of the original basic literature in the field. It is presumed that the candidate will know sufficient grammar to distinguish inflectional forms and that he will be able to translate in two hours 500 words with the aid of a dictionary.

2. *Students planning to take the examination must register personally in the office of the Department of Foreign Languages at least three weeks in advance of the test.*

3. Examinations are held at the office of the Department of Foreign Languages on the first Tuesday of October, February and June, at 2 p.m.

4. There is no limitation on the number of times the examination may be taken, but a \$5.00 fee will be charged for the second and subsequent examinations.

REQUIREMENTS FOR THE DEGREE OF DOCTOR OF EDUCATION

The Doctor of Education degree is offered for students who hold or expect to hold teaching or administrative positions in education and who desire to develop exceptional competence in special areas. The ability to explore and solve practical educational problems is emphasized. The requirements are the same as for the degree of Doctor of Philosophy except as specified below.

FOREIGN LANGUAGES. When the program of study and research does not involve the use of foreign languages the requirement may be waived by the Department of Education.

MAJOR AND MINOR SUBJECTS. The candidate must select one major area and one minor area in which he expects to develop exceptional competence. The minor may be a single area or may consist of a group of related areas selected to broaden the candidate's understanding of education. In addition to the major and minor, other areas if desired may be included in the program also. The amount of course work required in the major, minor, and related areas will vary according to the needs of each individual candidate.

PROJECT. Instead of completing a thesis as required for a candidate for the degree of Doctor of Philosophy, a candidate for this degree must demonstrate exceptional competence to work through field problems by completing a project in the major area. A Committee on Doctoral Research is appointed for each candidate. The committee is composed of three members at least two of whom are from the faculty of the College of Education. The committee passes upon the student's plans for research. The specialist in the student's major area serves as sponsor and provides detailed guidance for the project.

The regulations governing submission and form of copies of the project are the same as for theses submitted for the degree of Doctor of Philosophy.

WRITTEN EXAMINATIONS. Written examinations for the degree of Doctor of Education parallel those for the degree of Doctor of Philosophy in education.

FINAL ORAL EXAMINATION. The final examination covers the project and its relationship to the general field in which it lies and the candidate's attainments in related areas.

GRADUATE FEES

The fees paid by graduate students are as follows:

Matriculation fee of \$10.00. This is paid once only, upon first registration in the Graduate School.

Diploma fee for master's degree, \$10.00.

Graduation fee for doctor's degree including a hood, microfilming and binding of thesis, \$50.00.

At College Park

A fixed charge, each semester, of \$12.00 per semester credit hour for students carrying ten hours or less; for students carrying more than ten hours, \$120.00 for the semester.

Foreign Language Examination (first examination without charge), \$5.00.

Testing fee for Education majors, \$5.00.

Academic Information

Laboratory fees, where charged, range from \$1.00 to \$20.00 per course per semester.

Infirmary Fee, (Voluntary) \$5.00.

The Infirmary services normally furnished the undergraduate students are available to graduate students who elect to pay the fee of \$5.00 for the year (not including Summer School), provided that the fee is paid not later than the end of the first week of classes in the regular academic session. A graduate student entering in February may benefit in the same manner by the payment of \$2.50. This fee will not be remitted for graduate assistants, scholarship or fellowship students.

There is a \$3.00 fine for violation of the University parking regulations. All graduate students are expected to abide by these regulations, regardless of full-time or part-time attendance. The failure to register for a parking permit entails a \$5.00 fee.

At Baltimore

The fees for graduate work at the professional schools in Baltimore are determined by the individual school concerned. Students should consult the catalog of the respective school in which they intend to pursue their work.

LIVING EXPENSES AND SELF-HELP. The University in no way assumes responsibility for the housing of graduate students.

Board and lodging are available in many private homes in College Park and vicinity. The cost of board and room varies from about \$105.00 to \$140.00 a month, depending upon the desires of the individual. A list of accommodations is maintained by the housing bureau in the Office of the Dean of Men.

Application for student employment, aside from fellowships and assistantships, may be made through the Offices of the Dean of Men and the Dean of Women, or to department heads.

FELLOWSHIPS AND ASSISTANTSHIPS

FELLOWSHIPS. A number of fellowships have been established by the University. The stipend for the University fellows is \$800.00 for nine months and the remission of all graduate fees except the diploma fee. Several industrial and special fellowships, with varying stipends, are also available in certain departments.

University Fellows are permitted to carry a full graduate program, and they may satisfy the residence requirement for higher degrees in the normal time.

Applications for fellowships are made on blanks which may be obtained from the office of the Graduate School. The application, with the necessary credentials, is sent by the applicant directly to the Dean of the Graduate School.

Applications are forwarded by the Dean to the departments for their consideration and recommendation. The awards of University fellowships are on a competitive basis.

GRADUATE ASSISTANTSHIPS. A number of teaching and research assistantships are available in several departments. The compensation is \$180.00 per month unless otherwise specified and varies with the nature and amount of service required and with the terms of appointment. The amount of credit allowed toward a degree is normally a maximum of ten credit hours in a regular semester. The research assistants usually participate in research that meets the requirements for a master's or a doctor's degree.

Applications for graduate assistantships are made directly to the departments concerned and appointments are made through the regular channels for staff appointments. Further information regarding these assistantships may be obtained from the departments concerned.

RESIDENCE COUNSELING ASSISTANTSHIPS. Twenty-four assistantships are available to qualified graduate male students to act as supervisors in men's dormitories. Remuneration for all residence assistantships is \$1,800.00 per year, payable in ten monthly payments, plus remission of Graduate School fee. Further information about residence counseling assistantships can be obtained from the Office of the Dean of Men.

GRADUATE PRIZE OF THE COLLEGE PARK BRANCH OF AAUW

A Graduate Prize of \$100.00 will be awarded annually by the College Park Branch of the American Association of University Women to an outstanding woman student, admitted to candidacy for an advanced degree at the University of Maryland. The selection will be made by the Scholarship Committee of the Branch from candidates recommended by departments and the Graduate School.

STUDENT LOAN FUND

A Student Loan Fund is maintained by the College Park Branch of the American Association of University Women. It is administered through the Office of the Dean of Women, and is available to deserving women who are junior, senior or graduate students at the University of Maryland.

Likewise the Sigma Chapter of Phi Delta Gamma Fraternity for Graduate Women provides loans to graduate women of the University of Maryland.

For further information contact the office of the Graduate School.

COMMENCEMENT

Attendance is required at the June commencement if the degree is conferred at that time.

Academic Information

Application for diploma must be filed in the Office of the Registrar eight weeks before the date at which the candidate expects to obtain a degree except during the summer session.

Academic costume is required of all candidates at the June commencement. Those who so desire may purchase or rent caps and gowns at the Students' Supply Store. Orders must be filed eight weeks before the date of convocation but may be cancelled later if the student finds himself unable to complete his work for the degree.

METHOD OF NUMBERING COURSES AND COUNTING CREDIT HOURS

Courses for Advanced Undergraduates and Graduates are numbered 100 to 199; courses for Graduates only are numbered 200 and upward.

A course with a single number extends through one semester.

A course with a double number extends through two semesters.

The number of semester hour credits is shown by the arabic numerals in parentheses after the title of the course. Examples:

Course 101. Title (3). First semester.

If a laboratory course:

Course 101. Title (3). One lecture and two laboratory periods a week, first semester.

(This is a semester course: offered once a year.)

Course 101. Title (3). First and second semester.

(This is a semester course, repeated each semester, and except for research, seminar, and certain problem courses, must be taken only one semester.)

Course 103, 104. Title (3, 3). Three hours a week, first and second semesters.

If a laboratory course:

Course 103, 104. Title (3, 3). One lecture and two laboratory periods a week, first and second semesters.

(This is a course extending through two semesters and carrying three semester credits each semester.)

Course 103, 104. Title (3, 3). Three hours a week, second and first semesters.

(This is a course extending through two semesters, but it begins with the second semester.)

Course 105, f, s. Title (3, 3). Three hours a week, first and second semesters.

(This is alternate way of listing a two-semester course.)

GRADES

The following symbols are used for grades: "A", "B", "C" and "S"—Passing; "D" and "F"—Failure; "I"—Incomplete. Since graduate students must maintain an overall "B" average, every credit hour of "C" in course work must be balanced by a credit hour of "A." A grade of "A" in thesis research will not balance a grade of "C" in a course. All incomplete grades must be removed before the degree is conferred.

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CURRICULA AND REQUIRED COURSES

AERONAUTICAL ENGINEERING

Professors: SHERWOOD, CORNING AND SHEN.

Visiting Professor: WESKE.

Associate Professor: RIVELLO.

Lecturers: KURZWEG, NICOLAIDES, PAI AND WILSON.

The Department of Aeronautical Engineering offers courses and opportunities for research leading to the degree of Master of Science in Aeronautical Engineering. Steps are being taken toward the expansion of graduate work to include programs leading to the degree of Doctor of Philosophy.

Admission to the Graduate School for study in this Department is based primarily on the student having a Bachelor of Science degree in Aeronautical Engineering in addition to the requirements for admission under General Regulations. However, a student without the Bachelor of Science degree in Aeronautical Engineering may be accepted for graduate study if he has a Bachelor of Science degree in an allied field of science and shows evidence of sufficient preparation for graduate work in his chosen field of aeronautical engineering.

Students may elect off-campus graduate courses given by the University, but off-campus credit may count toward the course requirement only if taken after graduate admission has been obtained. For the degree of Master of Science, a minimum of six semester hours of graduate instruction, exclusive of research, from resident faculty members of this department must be included in the student's program and passed with a grade of "B" or higher. An acceptable thesis written under the guidance of the graduate faculty is also required.

Facilities for graduate research include a complete subsonic laboratory consisting of a 7.75 x 11 foot wind tunnel and related shops, offices and photographic equipment. For high speed research, a 6" x 6" supersonic wind tunnel is available with Schlieren optical system, instantaneous strain-gauge type pressure pick-ups, remote angle of attack control and other accessories. A 100 h.p. rotary vacuum pump provides adequate pumping capacity for 10 second runs at 2 minute intervals.

The general aerodynamics laboratory is equipped with the following major items: a two foot subsonic wind tunnel, a ballistics range for measuring supersonic drag of projectile-shaped bodies, a water table for simulating compressible flow by hydraulic analogy, a large electrolytic tank for the solution of potential flow problems, manometer boards, and high speed flash photographic equipment.

The structures laboratory has a 400,000 pound capacity universal testing machine, hydraulic tension-compression jacks and pumps, and lead shot bags for applying structural loading. Traction dynamometers and SR4 tension-compression load cells are available to measure loads. The laboratory has SR-4

strain indication equipment extensometers, compressometers, Huggenberger extensometers, and a recording oscillograph for measuring strain. Dial gauges and a transit are available for measuring deflections.

For Graduates and Advanced Undergraduates

Aero. E. 101. Aerodynamics I. (3)

Second semester. Three lectures a week. Prerequisites, Phys. 21 and Math. 21. Basic fluid mechanics and aerodynamic theory. (Sherwood.)

Aero. E. 102. Aerodynamics II. (2)

First semester. Two lectures a week. Prerequisite, Aero. E. 101. Elements of hydrodynamics and application to engineering problems. (Sherwood.)

Aero. E. 105. Airplane Fabrication Shop. (1)

Second semester. One laboratory period a week. Prerequisite, junior standing in aeronautical engineering. (Schreier.)

Aero. E. 106. Airplane Fabrication. (1)

First semester. One lecture period a week. Prerequisite, Aero. E. 105. Both Aero. E. 105 and Aero. E. 106 include aircraft sheet metal forming and fabrication. Airframe materials, sheet metal fabrication, machining, fasteners, welding, casting, forging, and costs. (Schreier.)

Aero. E. 107, 108. Airplane Design. (4, 4)

First and second semesters. Two lectures and two supervised calculation periods per week. Prerequisites, Aero. E. 101, Aero. E. 104, and M.E. 22, 23. Aero. E. 102 and Aero. E. 113 to be taken concurrently. Theory and method of airplane design, airplane stability and control, airloads, and structural design. Each student designs a jet transport, high speed private airplane or other suitable airplane of student's choice, based upon set specifications. Charts and formulas used in industry are derived and used as basis of design. Optimum airplane is obtained by variation of fundamental parameters. (Corning.)

Aero. E. 109, 110. Aircraft Power Plants. (3, 3)

First and second semesters. Two lectures and one laboratory period a week. Prerequisite, M.E. 100. Study of basic operating principles of reciprocating, turbojet, turboprop, ramjet, and rocket engines. Specific topics of study include thermodynamic processes, combustion, fuels, carburetion, supercharging, lubrication, and engine performance. Various engine tests are run in the laboratory. (Schreier.)

Aero. E. 111, 112. Aeronautical Laboratory. (2, 2)

First and second semesters. One lecture and one laboratory period a week. Prerequisite, Aero. E. 101. To be taken concurrently with Aero. E. 102 and Aero. E. 113. Wind tunnel tests. Structure tests. Ballistics tests. Fluid flow analogies. Report writing, original research project. (Staff.)

Aero. E. 113, 114. Mechanics of Aircraft Structures.

First and second semesters. First semester, 3 lectures a week. Second semester, 3 lectures and one calculation period a week. Prerequisites, M.E. 22, 23 and Math. 64. Principles and problems of airplane stress analysis and structural design. (Rivello.)

Aero. E. 115. Aerodynamics III. (3)

Second semester. Prerequisite, Aero. E. 102. Elementary theory of the flow of a compressible gas at subsonic and supersonic speeds. (Sherwood.)

Aero. E. 117. Aircraft Vibrations. (3)

First semester. Three lectures a week. Prerequisite, Math. 64. Vibration and other dynamic problems occurring in airplane structures. Specific topics of study include the single degree of freedom system, damping, forced vibrations, critical frequency, multiple degrees of freedom, and vibration isolation and absorption. (Corning.)

For Graduates

Aero. E. 200. Advanced Aerodynamics. (3)

First semester. Three lectures a week. Prerequisites, Aero. E. 115, Math. 64. Review of thermodynamics and physical properties of gases. One dimensional flow of a perfect compressible fluid. Shock waves. Fundamental equations of aerodynamics of compressible fluid. Two-dimensional linearized theory of compressible flow, Prandtl-Glauert Method, Ackeret method, Rayleigh-Janzen method. Hodograph method Karman-Tsien approximation. Two-dimensional transonic and hypersonic flows. Exact solutions of two dimensional isotropic flow. (Pai.)

Aero. E. 201. Advanced Aerodynamics. (3)

Second semester. Three lectures a week. Prerequisite, Aero. E. 200. Linearized theory of three-dimensional potential flow. Exact solution of axially symmetrical potential flow. Method of characteristics. (Two-dimensional and axially symmetrical flow.) Nozzle design; flow in jets; rotational flow of compressible fluid. One-dimensional viscous compressible flow. Laminar boundary layer of compressible fluids. (Pai.)

Aero. E. 202. Advanced Aircraft Structures. (3)

First semester. Three lectures a week. Prerequisites, Math. 64 and Aero. E. 113, 114, or permission of the instructor. Introduction to two-dimensional theory of elasticity, energy methods, plate theory, theory of elastic instability. (Rivello.)

Aero. E. 203. Advanced Aircraft Structures. (3)

Second semester. Three lectures a week. Prerequisites, Aero. E. 202. Aerodynamic heating of structures, thermal stresses, creep, creep bending and buckling, visco-elastic theory. (Rivello.)

Aero. E. 204. Aircraft Dynamics. (3)

First semester. Prerequisites, Math. 64 and Aero. E. 114. Dynamics of a rigid body and applications to airplane dynamics. Generalized coordinates and Lagrange's equations. Vibrations of simple systems. Dynamics of elastically connected masses. Influence coefficients. Mode shapes and principal oscillations. Transient stresses in an elastic structure. (Shen.)

Aero. E. 205. Aircraft Dynamics. (3)

Second semester. Prerequisites, Math. 64 and Aero. E. 101. Wing divergence and aileron reversal. Theory of two dimensional oscillating airfoil. Flutter problems. Corrections for finite span. Compressibility effects. (Shen.)

Aero. E. 206, 207. Advanced Aircraft Power Plants. (3, 3)

First and second semesters. Two lectures and one laboratory period a week. Prerequisites, M. E. 100; Aero. E. 109, 110. Special problems of thermodynamics and dynamics of aircraft power plants; jet and rocket engines. Research in power plant laboratory. (Staff.)

Aero. E. 208. Advanced Aircraft Design. (3)

First semester. Three lectures a week. Prerequisites, Aero. E. 101, 102, 113, 114. Theory and method of airplane design. Special emphasis is placed on the derivations and theoretical background of the formulas and experimental data used. (Corning.)

Aero. E. 209. Stability and Control. (3)

Second semester. Three lectures a week. Prerequisites, Aero. E. 101, 102. Dynamic longitudinal and lateral stability and control, preceded by a brief introduction to static stability. (Corning.)

Aero. E. 210. Aerodynamic Theory. (3)

First semester. Prerequisites, Aero. E. 101, Math. 64. Fundamental equations in fluid mechanics. Irrotational motion. Circulation theory of lift. Thin airfoil theory. Lifting line theory. Wind tunnel corrections. Propeller theories. Linearized equations in compressible flow. (Shen.)

Aero. E. 211. The Design and Use of Wind Tunnels (Supersonic). (3)

First and second semesters. The design and use of wind tunnels (supersonic). Review of basic aerodynamics and thermodynamics. Problems in supersonic tunnel design such as pumping, power supply, condensation and driers. Equipment for measuring results, including balances, manometer, optical instruments, such as Schlieren, spark illumination and X-ray equipment. Investigations in supersonic wind tunnels are described with special reference to similitude required for conversion to full scale. (Kurzweg.)

Aero. E. 212, 213. Bodies at Supersonic Speeds. (3, 3)

First and second semesters. Prerequisites, degree in Aero. E. or M. E. or equivalent, and consent of instructor. Brief review of gasdynamics, drag, lift, stability, and damping on a body in a supersonic stream. Special aerodynamic problems in the design of supersonic missiles. Methods for obtaining accurate test data on the aerodynamic characteristics of supersonic missiles. (Kurzweg.)

Aero. E. 214. Seminar.

(Credit in accordance with work outlined by the aeronautical engineering staff.) First and second semesters. Prerequisite, graduate standing. (Staff.)

Aero. E. 216. Selected Aeroballistics Problems. (3)

First semester. Physical processes and aerothermodynamic laws connected with the flow around supersonic missiles. Boundary layer problems and the transfer of heat and mass. Prerequisite, degree in aeronautical engineering or electrical engineering or equivalent and consent of instructor. (Kurzweg.)

Aero. E. 217. Aerodynamics of Viscous Fluids. (3)

Second semester. Fundamental concepts. Navier-Stokes' equations. Simple exact solutions. Laminar boundary layer theory. Pohlhausen method. Turbulent boundary layer;

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mixing length and similarity theories. Boundary layer in compressible flow. Prerequisites, Aero. E. 101, Math. 64. (Shen.)

Aero. E. 218. Selected Topics in Aerodynamic Theory. (3)

First or second semester. Prerequisites, Aero. E. 210, 115. Topics of current interest and recent advances in the field of aerodynamics. (Shen.)

Aero. E. 399. Research.

(Credit in accordance with work outlined by Aero. Engr. staff.) First and second semesters. Prerequisite, graduate standing. (Staff.)

AGRICULTURAL ECONOMICS

Professors: POFFENBERGER, BEAL AND WALKER.

Visiting Professor: TAYLOR.

Associate Professors: HAMILTON, MURRAY, SHULL AND SMITH.

Assistant Professors: ISHEE, SWOPE AND WYSONG.

The Department offers a course of study leading to the degree of Master of Science and Doctor of Philosophy. Although the major field is Agricultural Economics, thesis topics may be selected and courses concentrated in Farm Management, Farm Taxation, Farm Finance, Marketing, Land Economics, Agricultural Policy and Foreign Agricultural Trade.

Department requirements, supplementary to the Graduate School, have been formulated for the guidance of candidates for graduate degrees. Copies of these requirements may be obtained from the Department of Agricultural Economics.

For Graduates and Advanced Undergraduates

A. E. 101. Marketing of Farm Products. (3)

First semester. Prerequisites, Econ. 31, 32, or Econ. 37. The development of marketing, its scope, channels, and agencies of distribution, functions, costs, methods used and services rendered. (Wysong.)

A. E. 103. Cooperation in Agriculture. (3)

First semester. (Offered 1959-60.) Historical and comparative development of farmers' cooperative organizations; reasons for failure and essentials to success; commodity developments; operative practices; banks for cooperatives; present trends. (Smith.)

A. E. 104. Farm Finance. (3)

Second semester. (Offered 1960-61.) A study of credit principles as applied to private and cooperative farm business and the agencies extending farm credit. The needs for and benefits of farm insurance, including fire, crop, livestock, and life insurance. (Ishee.)

A. E. 106. Prices of Farm Products. (3)

Second semester. A general course in prices, price relationships, and price analysis, with emphasis on prices of agricultural products. (Wysong.)

A. E. 107. Analysis of the Farm Business. (3)

First semester. A concise, practical course in the keeping, summarizing, and analyzing of farm accounts. (Hamilton.)

A. E. 108. Farm Management. (3)

Second semester. A study of the organization and operation of farms from the standpoint of efficiency, selection of farms, size of farms, leasing systems, and factors affecting profits. Students will make an analysis of the actual farm business and practices of different types of farms, and make specific recommendations as to how these farms may be organized and operate as successful businesses. (Hamilton.)

A. E. 111. Land Economics. (3)

First semester. (Offered 1959-60.) A study of the principles, problems and policies in the utilization of land with special emphasis on agricultural land. (Ishee.)

A. E. 112. Economic Development of American Agriculture. (3)

First semester. (Offered 1960-61.) This course is designed to acquaint students with major economic development in American agriculture. It places particular emphasis upon the economic impact of major agricultural movements, such as, colonial agrarianism, the disposition of the public domain, farm organizations, recent governmental farm programs and the relationship of agriculture to public affairs. (Beal.)

A. E. 114. Foreign Trade in Farm Products. (3)

First semester. (Offered 1959-60.) Economic principles in historical setting, trade barriers, foreign exchange problems, measures to promote trade, past and prospective trends of American imports and exports of farm products. (Shull.)

A. E. 115. Marketing of Dairy Products. (2)

First semester. (Offered 1960-61.) A study of principles and practices in the marketing of milk and manufactured dairy products, including the influence of significant geographical and institutional relationships on costs and methods of distribution. (Beal.)

A. E. 116. Marketing of Fruits and Vegetables. (2)

Second semester. (Offered 1960-61.) A study of principles and practices in the marketing of fresh and processed fruits and vegetables, including the influence of significant geographical and institutional relationships on costs and methods of distribution. (Staff.)

A. E. 117. Economics of Marketing Eggs and Poultry. (3)

Second semester. (Offered 1959-60.) This course embraces the economic phases of egg and poultry marketing. Supply and demand factors, including trends, will be discussed along with marketing methods, marketing costs and margins, market facilities, transportation, government grading, storage and efficiency in marketing. Consumer preference, acceptance and purchases will be related to consumer income, pricing of competitive products, and display methods. (Smith.)

A. E. 118. Foreign Agricultural Policies. (3)

First semester. This course deals with how the agricultural policies of the United States and foreign countries of major agricultural importance are formulated and conducted. Specific policies are evaluated. The effect of various incentives and

Agricultural Economics

barriers to American exports and imports of agricultural products is appraised with the assistance of visiting discussion leaders working at the policy level in the United States and other major agricultural countries. (Taylor.)

A. E. 119. Foreign Agricultural Economics. (3)

Second semester. This course deals with differences between the agricultural economies of several countries and their significance to world-wide production, trade, and consumption of the agricultural products of major importance to the United States. Special emphasis is given to the roles of institutional and governmental arrangements. (Taylor.)

A. E. 198. Research Problem. (1-2) (2 Cr. Max.)

First and second semesters. With the permission of the instructor, students will work on any research problems in agricultural economics. There will be occasional class meetings for the purpose of making reports on progress of work. (Staff.)

A. E. 199A-B. Seminar. (1, 1)

First and second semesters. Students will prepare and present reports on economic literature and current agricultural economic problems. (Hamilton.)

Technology of Market Eggs and Poultry.

See Poultry Husbandry, P. H. 104.

Poultry Industrial and Economic Problems.

See Poultry Husbandry, P. H. 107.

Market Milk.

See Dairy, Dairy 109.

Livestock Markets and Marketing.

See Animal Husbandry, A. H. 150.

Meat and Meat Products.

See Animal Husbandry, A. H. 160.

Advertising.

See Business Administration, B. A. 151.

Retail Store Management.

See Business Administration, B. A. 154.

For Graduates

A. E. 208. Agricultural Policy. (3)

Second semester. The evolution of agricultural policy in the United States, emphasizing the origin and development of governmental programs, and their effects upon agricultural production, prices and income. (Beal.)

A. E. 210. Agricultural Taxation. (3)

First semester. Principles, theory and practical problems of taxation applied to the field of agriculture; trends in farm taxes; farm tax burdens; equalizing and reducing farm tax burdens; taxation of farm cooperatives; forest lands and interstate agricultural commerce; application of income taxes and sales taxes to farmers; taxation of agriculture in foreign countries. (Walker.)

A. E. 211. Functional Aspects of Farm Taxation. (3)

Second semester. Two lectures and one laboratory period a week. Taxation policies and inter-governmental allocations and grants-in-aid as they affect public services for rural people, with special emphasis on public education, public highways, public welfare, social security, public debt; and governmental research, extension, and regulatory activities directly concerning agriculture. (Walker.)

A. E. 214. Advanced Agricultural Marketing. (3)

First semester. Advanced study of the complex theoretical, institutional and legal factors governing both domestic and foreign agricultural trade, with particular attention given to policies and practices affecting cost and price. (Beal.)

A. E. 216. Advanced Farm Management. (3)

Second semester. An advanced course in farm organization and management which applies the economic principles of farm production to the operation of farms of different sizes, types, operations, and geographical locations. Consideration is also given to adjustments which have taken place in farming specific areas and probable changes in the future. (Ishee.)

A. E. 218. Agricultural Economics Research Techniques. (3)

First semester. A study and an appraisal of agricultural economics research techniques. Experience is given in outlining and conducting research projects. A critical appraisal is made of methods of analysis and the presentation of results. (Beal.)

A. E. 219. Advanced Land Economics. (3)

Second semester. A critical analysis of the principles and problems in issuing and controlling land resources, including a review of land policies, is given, with special consideration being placed on the problems of submarginal lands, range lands, and water resources. Conservation of various land resources is appraised; problems of landed property are presented; and criteria essential to the development of a sound land policy are studied. (Ishee.)

A. E. 220. World Agricultural Production. (3)

First semester. A world-wide appraisal of the economic significance of the growth of population, changes in food and fiber requirements, development of land resources, development of crop and livestock productivity, substitute or supplementary products from factory and sea, the economic imbalance between developed and under-developed countries, financial and social limitations, and organized international agricultural development activities. (Taylor.)

A. E. 301. Special Problems in Farm Economics. (2) (4 Cr. Max.)

First and second semesters. An advanced course dealing extensively with some of the economic problems affecting the farmer, such as land values, taxation, credit, prices, production adjustments, transportation, marketing, and cooperation. (Staff.)

A. E. 302. Seminar. (1) (4 Cr. Max.)

First and second semesters. Students will be assigned research in agricultural economics under the supervision of the instructor. The work will consist of original investigation in problems of agricultural economics. (Staff.)

Agriculture

A. E. 399. *Research.*

Credit according to work accomplished. This course will consist of special reports by students on current economic subjects, and a discussion and criticism of the same by the members of the class and instructional staff. (Staff.)

AGRICULTURE

Associate Professor: SCHULTZ.

Agr. 100. Introductory Agricultural Biometrics. (3)

First semester. Two lectures and one laboratory period per week. Introduction to fundamental concepts underlying the application of biometrical methods to agricultural problems with emphasis on graphical presentation of data, descriptive statistics, chi-square and t-tests, and linear regression and correlation. (Schultz.)

Agr. 200. Agricultural Biometrics. (3)

Second semester. Two lectures and one laboratory period per week. Prerequisite, Agr. 100 or equivalent. A continuation of Agr. 100 with emphasis on analysis of variance and co-variance, multiple and curvilinear regression, sampling, experimental design and miscellaneous statistical techniques as applied to agricultural problems. (Schultz.)

Agr. 202, 203. Advanced Biological Statistics. (2, 2)

First and second semesters. Prerequisite, approval of instructor. An advanced course dealing with specialized experimental designs, sampling techniques and elaborations of standard statistical procedures as applied to the animal and plant sciences. (Schultz.)

AGRICULTURAL EDUCATION AND RURAL LIFE

Professor: WARNER.

Assistant Professor: HOPKINS.

The Department of Agricultural Education offers work leading to the degree of Master of Science. Students may choose either a program on vocational agriculture or extension education. Either program may be pursued on a part-time or full-time basis.

VOCATIONAL AGRICULTURE

Students pursuing the program in vocational agriculture will be expected to have taken, or to take concurrently with the program, a minimum of sixteen credits in education, including a course in methods of teaching vocational agriculture. They should take advantage of special courses offered for teachers of vocational agriculture in the summer, and will find numerous acceptable courses offered in evenings and on Saturday during the school year. Some students may elect a limited number of special problems courses, mostly in agriculture.

EXTENSION EDUCATION

Students pursuing the extension education program will be expected to have had a minimum of two years of experience as an extension worker and eight undergraduate credits in extension and/or education courses. Deficiencies in prerequisites must be made up. This can be done while pursuing the graduate program. The major courses for these students will be selected from courses emphasizing rural education, extension education, adult education, human development and rural sociology. A student may select a program with a major emphasis in extension or adult education. Each student will be assigned to an advisor for consultation in developing an acceptable program.

For Graduates and Advanced Undergraduates

R. Ed. 107. Observation and Analysis of Teaching Agriculture. (3)

Second semester. Two lectures and one laboratory period a week. This course deals with an analysis of pupil learning in class groups. (Hopkins.)

R. Ed. 109. Teaching Secondary Vocational Agriculture. (3)

First semester. A comprehensive course in the work of high school departments of vocational agriculture. It emphasizes particularly placement, supervised farming programs, the organization and administration of Future Farmer activities, and objectives and methods in all-day instruction. (Hopkins.)

R. Ed. 111. Teaching Young and Adult Farmer Groups. (1)

First semester. Characteristics of young and adult farmer instruction in agriculture. Determining needs for and organizing a course; selecting materials for instruction, and class management. Emphasis is on the conference method of teaching. (Hopkins.)

R. Ed. 112. Departmental Management. (1)

Second semester. One laboratory period a week. Prerequisites, R. Ed. 107 and 109, or permission of the Head of the Department. The analysis of administrative programs for high school departments of vocational agriculture. Investigations and reports. (Hopkins.)

R. Ed. 114. Rural Life and Education. (3)

Second semester. An intensive study of the educational agencies at work in rural communities, stressing an analysis of school patronage areas, the possibilities of normal life in rural areas, early beginnings in rural education, and the conditioning effects of educational offerings. (Staff.)

R. Ed. 150. Extension Education. (2)

Second semester. The Agricultural Extension Service as an educational agency. The history, philosophy, objectives, policy, organization, legislation, and methods used in extension work. (Warner.)

R. Ed. 160. Agricultural Communications. (2)

First semester. A general introduction to communications and the application of communication principles and problems of teaching agricultural workers, person to person, with groups and through mass media. (Warner.)

Agricultural Education and Rural Life

R. Ed. S170. Workshop: Teaching Conservation of Natural Resources. (6)

Summer session only. Laboratory fee \$25.00. This workshop is devoted to a study of the State's basic wealth, its natural resources, natural resource problems and practices pertinent to local, state, national and world welfare.

For Graduates

R. Ed. 201. Rural Life and Education. (3)

Second semester. Prerequisite, R. Ed. 114 or equivalent. A sociological approach to rural education as a movement for a good life in rural communities. (Given in accordance with demand, but not more often than alternate years). (Staff.)

R. Ed. 203. Farm Organizations and Rural Education. (3)

First semester. Prerequisite, R. Ed. 114 or equivalent. The part played by farm organizations in formal and informal education in the rural community. (Given in accordance with demand, but not more often than alternate years). (Hopkins.)

R. Ed. 207, 208. Problems in Vocational Agriculture. (2, 2)

First and second semesters. In this course special emphasis is placed upon the current problems facing teachers of vocational agriculture. It is designed especially for persons who have had several years of teaching experience in this field. (Given in accordance with demand, but not more often than alternate years). (Hopkins.)

R. Ed. S207 A-B. Problems in Teaching Vocational Agriculture. (1, 1)

Summer session only. A critical analysis of current problems in the teaching of vocational agriculture with special emphasis upon recent developments in all-day programs. (Staff.)

R. Ed. S209 A-B. Adult Education in Agriculture. (1, 1)

Summer session only. Principles of adult education as applied to rural groups, especially young and adult farmers. Organizing classes, planning courses and instructional methods are stressed. (Staff.)

R. Ed. S210 A-B. The Land Grant College System. (1, 1)

Summer session only. Development of teaching, research and extension in Land Grant colleges and the role these colleges have played in improving rural conditions. (Staff.)

R. Ed. S213 A-B. Supervision and Administration of Vocational Agriculture. (1, 1)

Summer session only. Administrative and supervisory problems in Vocational Agriculture including scheduling, local administrative programs, supervisor-teacher relationships and the responsibilities of superintendents and principals in the program. (Staff.)

R. Ed. 215. Supervision of Student Teaching. (1)

Arranged. The role of the supervising teacher in checking progress, supervising and grading student teachers. Particular emphasis will be given to the region-wide program in training teachers of vocational agriculture, including the evaluation of beginning teachers. (Given in accordance with demand, but not more often than alternate years). (Staff.)

R. Ed. 240. Agricultural College Instruction. (1)

Second semester. Open to graduate students and members of the faculty in the College of Agriculture. A seminar type of course consisting of reports, discussions, and lectures

dealing with the techniques and procedures adapted to teaching agricultural subjects at the college level. (Given in accordance with demand, but not more than alternate years). (Staff.)

R. Ed. S250 A-B. Critique in Rural Education. (1, 1)

Summer session only. Current problems of teaching agriculture are analyzed and discussed. Students are required to make investigations, prepare papers and make reports. (Staff.)

R. Ed. 301. Field Problems in Rural Education. (1-3)

First and second semesters and summer session. Prerequisite, six semester hours of graduate study. Problems accepted depend upon the character of the work of the student and the facilities available for study. Periodic conferences required. Final report must follow accepted pattern for field investigations. (Hopkins.)

R. Ed. 302. Seminar in Rural Education. (1, 1)

First and second semesters. Problems in the organization, administration, and supervision of the several agencies of rural education. Investigations, papers, and reports. (Staff.)

R. Ed. 399. Research.

First and second semesters and summer session. Credit hours according to work done. (Staff.)

AGRONOMY—CROPS AND SOILS

Professors: WAGNER, ROTHGEB AND STREET.

Associate Professors: AXLEY, BOURBEAU, DECKER, LEFFEL AND STRICKLING.

Assistant Professor: SANTELMANN.

The Department of Agronomy offers a graduate course of study leading to the degree of Master of Science and to the degree of Doctor of Philosophy. The student may pursue major work in the Crops Division or in the Soils Division of the Department. A thesis based on original research is required for each degree. Ample laboratory and greenhouse facilities for graduate work are available on the campus. The Plant Research Farm, the Forage Research Farm, and the Tobacco Experimental Farm offer adequate nearby field research facilities. Many projects of the Department are conducted in cooperation with the Agricultural Research Service of the United States Department of Agriculture with headquarters located three miles from the campus.

Departmental regulations have been assembled for the guidance of candidates for graduate degrees. Copies of these regulations are available from the Department of Agronomy.

Courses Offered in Agronomy

A. CROPS

For Graduates and Advanced Undergraduates

Agron. 103. Crop Breeding. (2)

Second semester, alternate years. Prerequisite, Bot. 117 or Zool. 104. Principles and methods of breeding annual self and cross-pollinated plants and perennial forage species. (Offered 1960-61). (Leffel.)

Agron. 104. Tobacco Production. (3)

Second semester. Three lectures a week. Prerequisite, Bot. 1. A study of the history, adaptation, distribution, culture, and improvement of various types of tobacco, with special emphasis on problems in Maryland tobacco production. Physical and chemical factors associated with yield and quality of tobacco will be stressed. (Street.)

Agron. 107. Cereal Crop Production. (3)

First semester, alternate years. Two lectures and one laboratory period a week. Prerequisite, Bot. 1. Study of the principles and practices of corn, wheat, oats, barley, rye, and soybean production. (Offered 1960-61.) (Clark.)

Agron. 108. Forage Crop Production. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisite, Bot. 1. Study of the production and management of grasses and legumes for quality hay, silage and pasture. (Decker.)

Agron. 109. Turf Management. (2)

First semester, alternate years. Two lectures a week. Prerequisite, Bot. 1. A study of principles and practices in management of turf for lawns, athletic fields, playgrounds, airfields, and highway planting. (Offered 1959-60.) (Staff.)

Agron. 151. Cropping Systems. (2)

Second semester. Two lectures a week. Prerequisite, Agron. 1 or equivalent. The coordination of information from various courses in the development of balanced cropping systems, appropriate to different objectives in various areas of the State and Nation. (Wagner.)

Agron. 152. Seed Production and Distribution. (2)

First semester, alternate years. One lecture and one laboratory period a week. Prerequisite, Agron. 1 or equivalent. A study of seed production, processing, and distribution; Federal and State seed control programs; seed laboratory analyses; release of new varieties and maintenance of foundation seed stocks. (Offered 1960-61.) (Newcomer.)

Agron. 154. Weed Control. (3)

First semester, alternate years. Two lectures and one laboratory period a week. Prerequisite, Agron. 1 or equivalent. A study of the use of cultural practices and chemical herbicides in the control of weeds in field crops and turf. (Offered 1959-60.) (Santelmann.)

Additional courses under C. CROPS AND SOILS may be taken.

For Graduates

Agron. 201. Advanced Crop Breeding. (2)

First semester, alternate years. Prerequisite, Agron. 103 or equivalent. Genetic, cytogenetic, and statistical theories underlying methods of plant breeding. A study of quantitative inheritance, heterosis, heritability, interspecific and intergeneric hybridization, polyploidy, sterility mechanisms, inbreeding and outbreeding, and other topics as related to plant breeding. (Offered 1959-60.) (Leffel.)

Agron. 204. Technic in Field Crop Research. (2)

Second semester, alternate years. Field plot technic, application of statistical analysis to agronomic data, and preparation of the research project. (Offered 1960-61.) (LeClerg.)

Agron. 205. Advanced Tobacco Production. (2)

First semester, alternate years. Two lectures a week. Prerequisite, permission of instructor. A study of the structural adaptation and chemical response of tobacco to environmental variations. Emphasis will be placed on the alkaloids and other unique components. (Offered 1959-60.) (Street.)

Agron. 207. Advanced Forage Crops. (2)

First semester, alternate years. Two lectures a week. Prerequisites, Bot. 101, Chem. 31 and 32, or equivalent, or permission of instructor. A fundamental study of physiological and ecological responses of grasses and legumes to environmental factors, including fertilizer elements, soil moisture, soil temperature, air temperature, humidity, length of day, quality and intensity of light, wind movement, and defoliation practices. Relationship of these factors to life history, production, chemical and botanical composition, quality, and persistence of forages will be considered. (Offered 1960-61.) (Decker, Wagner.)

Agron. 208. Research Methods. (2)

Second semester. Prerequisite, permission of staff. Development of research viewpoint by detailed study and report on crop research of the Maryland Experiment Station or review of literature on specific phases of a problem. (Staff.)

Agron. S210. Cropping Systems. (1)

Summer session only. An advanced course primarily designed for teachers of vocational agriculture and county agents. It deals with outstanding problems and the latest developments in the field. (Wagner.)

Additional courses under C. CROPS AND SOILS may be taken.

B. SOILS

*For Graduates and Advanced Undergraduates**Agron. S110. Soil Management. (1)*

Summer session only. An advanced course primarily designed for teachers of vocational agriculture and county agents dealing with factors involved in management of soils in general and of Maryland soils in particular. Emphasis is placed on methods of maintaining and improving chemical, physical, and biological characteristics of soils. (Strickling.)

Agron. 111. Soil Fertility Principles. (3)

First semester, alternate years. Three lectures a week. Prerequisite, Agron. 10. A study of the chemical, physical, and biological characteristics of soils that are important in growing crops. Soil deficiencies of physical, chemical, or biological nature and their correction by the use of lime, fertilizers, and rotations are discussed and illustrated. (Offered 1960-61.) (Strickling.)

Agron. 112. Commercial Fertilizers. (3)

Second semester. Three lectures a week. Prerequisite, Agron. 10 or permission of instructor. A study of the manufacturing and distribution of commercial fertilizers. (Axley.)

Agron. 113. Soil Conservation. (3)

First semester, alternate years. Two lectures and one laboratory period a week. Prerequisite, Agron. 10 or permission of instructor. A study of the importance and causes

Agronomy

of soil erosion, and methods of soil erosion control. Special emphasis is placed on farm planning for soil conservation. The laboratory period will be largely devoted to field trips. (Offered 1960-61.) (Miller.)

Agron. 114. Soil Classification and Geography. (4)

Second semester. Three lectures and one laboratory period a week. Prerequisite, Agron. 10, or permission of instructor. A study of the genesis, morphology, classification and geographic distribution of soils. The broad principles governing soil formation are explained. Attention is given to the influence of geographic factors on the development and use of soils in the United States and other parts of the world. The laboratory periods will be largely devoted to field trips and to a study of soil maps of various countries. (Bourbeau.)

Agron. 116. Soil Chemistry. (3)

First semester, alternate years. One lecture and two laboratory periods a week. Prerequisite, Agron. 10, or permission of instructor. A study of the chemical composition of soils; cation and anion exchange; acid, alkaline and saline soil conditions; and soil fixation of plant nutrients. Chemical methods of soil analysis will be studied with emphasis on their relation to fertilizer requirements. (Offered 1960-61.) (Axley.)

Agron. 117. Soil Physics. (3)

First semester, alternate years. Two lectures and one laboratory period a week. Prerequisites, Agron. 10 and a course in physics, or permission of instructor. A study of physical properties of soil with special emphasis on relationship to soil productivity. (Offered 1959-60.) (Strickling.)

Agron. 119. Soil Mineralogy. (4)

First semester, alternate years. Two lectures and two laboratory periods a week. Prerequisite, permission of instructor. A study of the fundamental laws and forms of crystal symmetry and essentials of crystal structure; structure, occurrence, association and uses of minerals, determination of minerals by means of their morphological, chemical and physical properties. Particular attention is given to soil-forming minerals. Laboratory periods will be devoted to a systematic study of about 75 minerals. (Offered 1959-60.) (Bourbeau.)

Additional courses under C. CROPS AND SOILS may be taken.

For Graduates

Agron. 250. Advanced Soil Mineralogy. (3)

First semester, alternate years. Three lectures a week. Prerequisites, Agron. 10, Agron. 119 and permission of instructor. A study of the structure physical-chemical characteristics and identification methods of soil minerals, particularly clay minerals, and their relationship to soil genesis and productivity. (Offered 1960-61.) (Bourbeau.)

Agron. 251. Advanced Methods of Soil Investigation. (3)

First semester, alternate years. Three lectures a week. Prerequisites, Agron. 10 and permission of instructor. An advanced study of the theory of the chemical methods of soil investigation with emphasis on problems involving application of physical chemistry. (Offered 1959-60.) (Axley.)

Agron. 252. Advanced Soil Physics. (3)

Second semester, alternate years. Two lectures and one laboratory period a week. Prerequisites, Agron. 10 and permission of instructor. An advanced study of physical properties of soils. (Offered 1959-60.) (Strickling.)

Agron. 253. Advanced Soil Chemistry. (3)

First semester, alternate years. One lecture and two laboratory periods a week. Prerequisites, Agron. 10 and permission of instructor. A continuation of Agron. 116 with emphasis on soil chemistry of minor elements necessary for plant growth. (Offered 1960-61.) (Axley.)

Additional courses under C. CROPS AND SOILS may be taken.

C. CROPS AND SOILS

For Graduates

Agron. 260. Recent Advances in Agronomy. (2-4)

First semester. Two hours each year. Total credit four hours. Prerequisite, permission of instructor. A study of recent advances in Agronomy research. (Staff.)

Agron. 302. Agronomy Seminar. (1, 1)

First and second semesters. Total credit toward Master of Science degree, 2; toward Ph.D. degree, 6. Prerequisite, permission of instructor. (Staff.)

Agron. 399. Research.

First and second semesters. Credit according to work done. (Staff.)

AMERICAN CIVILIZATION

Professor: BODE AND COOPERATING SPECIALISTS.

The American Civilization program offers work leading to both the degrees of Master of Arts and Doctor of Philosophy. The departments of English, History, Government and Politics, and Sociology join to offer integrated plans of study. In his class work the student will emphasize the offerings of any one of these departments. For lists of courses from which his particular program is to be developed, he is to see principally the listings of the four departments just mentioned. The Executive Secretary of the program will serve as the student's advisor in consultation with the chairman of the department in the field of the student's special interest.

Amer. Civ. 137, 138. Conference Course in American Civilization. (3, 3)

First and second semesters. Four American classics, drawn from the fields of the cooperating departments, are studied in detail each semester. Specialists from the appropriate departments lecture on these books. The classics for this year are Franklin's *Autobiography*, *The Life and Writings of Thomas Jefferson*, De Tocqueville's *Democracy in America*, Schlesinger's *The Age of Jackson*, for the first semester; and for the second semester, Thoreau's *Walden*, Howells' *The Rise of Silas Lapham*, Veblen's *The Theory of the Leisure Class*, and Warner's *Democracy in Jonesville*. The Conference course,

or either semester of it, may be chosen by a student outside the program as an elective. It also counts as major credit for the four cooperating departments. The course meets like a seminar, once a week.

ANIMAL HUSBANDRY

Professors: FOSTER AND GREEN.

Associate Professor: LEFFEL.

Assistant Professor: WINGERT.

The Department of Animal Husbandry offers work leading to the degrees of Master of Science and Doctor of Philosophy. Although the major field is Animal Husbandry, course work and thesis problems are offered in the areas of animal breeding, nutrition, and livestock production.

For Graduates and Advanced Undergraduates

A. H. 111. Animal Nutrition. (3)

First semester. Three lectures a week. Prerequisites, Chem. 31, 32, 33, 34; A. H. 110. Graduate credit allowed, with permission of instructor. Processes of digestion, absorption, and metabolism of nutrients; nutritional balances; nature of nutritional requirements for growth, production, and reproduction are considered. (Leffel.)

A. H. 120. Principles of Breeding. (3)

Second semester. Three lectures a week. Prerequisites, Zool. 104 or Bot. 117 and A. H. 130 or A. H. 131 or A. H. 132 or Dairy 101. Graduate credit (1-3 hours), allowed with permission of instructor. The practical aspects of animal breeding, heredity, variation, selection, development, systems of breeding, and pedigree study are considered. (Green.)

A. H. S130. Beef Cattle. (1)

Summer session. Prerequisite, permission of instructor. This course is designed primarily for teachers of Vocational Agriculture and Extension Service Workers. Principles and practices underlying the economical production of beef cattle, including a study of the breeds and their adaptability, selection, breeding, feeding, management, and marketing of purebred and commercial cattle. (Foster.)

A. H. 150. Livestock Markets and Marketing. (2)

First semester. Two lectures a week. Prerequisite, A. H. 1. Graduate credit allowed, with permission of instructor. History and development of livestock markets and systems of marketing; trends of livestock marketing; effect of changes in transportation and refrigeration facilities; the merchandising of meat products are considered. (Wingert.)

For Graduates

A. H. 205. Advanced Breeding. (2)

Second semester, alternate years. Two lectures a week. Prerequisites, A. H. 120, or equivalent, and Biological Statistics. This course deals with the more technical phases of heredity and variation, selection indices, breeding systems, and inheritance in farm animals. (Offered 1959-60). (Green.)

A. H. 206. Advanced Livestock Management. (3)

First semester, alternate years. Two lectures and one laboratory period a week. Prerequisite, approval of staff. An intensive study of the newer developments in animal breeding, animal physiology, animal nutrition, endocrinology, and other closely allied fields as they apply to the management and production of livestock. (Offered 1960-61.) (Staff.)

A. H. 207. Advanced Livestock Nutrition. (3)

Second semester, alternate years. Three lectures a week. Prerequisites, Chem. 31, 32, 33, 34, or equivalent, and A. H. 111, or permission of instructors. Experimental techniques and recent developments in the feeding and nutrition of beef cattle, sheep and swine are presented. (Offered 1960-61.) (Leffel, Wingert.)

A. H. 301. Special Problems in Animal Husbandry. (1-2) (4 Cr. Max.)

First and second semesters. Work assigned in proportion to amount of credit. Prerequisite, approval of staff. Problems will be assigned which relate specifically to the character of work the student is pursuing. (Staff.)

A. H. 302. Seminar. (1) (5 Cr. Max.)

Students and staff discuss topics related to Animal Husbandry. (Staff.)

A. H. 399. Research. (1-6)

First and second semesters. Credit to be determined by the work done. With the approval of the staff, the student will be required to pursue original research in some phase of Animal Husbandry, carry the same to completion, and report the results in the form of a thesis. (Staff.)

BOTANY

Professors: BAMFORD, GAUCH, COX, APPLEMAN (EMERITUS) AND NORTON (EMERITUS).

Associate Professors: BROWN, KRAUSS, D. T. MORGAN AND RAPPLEYE.

Assistant Professors: SISLER, JENKINS, WILSON AND PATERSON.

The Department of Botany offers a graduate course of study leading to the degree of Master of Science and to the degree of Doctor of Philosophy. The student may pursue major work in any one of the three main divisions of the Department, namely: Plant Physiology, Plant Pathology, or Plant Morphology, Cytology and Cytogenetics. Since a thesis based on original research is required for each degree, a qualified student may be allowed to pursue a problem of his own choosing, but it is more probable that the subject of his research will be that already in progress since the Department is devoted to a study of basic agricultural problems as well as projects of a more fundamental nature. An individual employed at a nearby institution may submit a thesis based on his research work at the institution under the direction of, and subject to prior approval by, a member of the faculty.

Laboratory facilities are available for research in each division, and there are ample greenhouses and plot space available on the campus or adjacent University farm land.

In addition to the normal requirements of the Graduate School, one must possess a reading knowledge of either French or German, before the Master of Science degree is granted.

A. PLANT PHYSIOLOGY

For Graduates and Advanced Undergraduates

Bot. 101. Plant Physiology. (4)

First semester. Two lectures and two laboratory periods a week. Prerequisites, Bot. 1 and general chemistry. Laboratory fee, \$5.00. A survey of the general physiological activities of plants. (Krauss.)

Bot. 102. Plant Ecology. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisite, Bot. 11 or equivalent. Laboratory fee, \$5.00. A study of plants in relation to their environments. Plant successions and formations of North America are treated briefly and local examples studied. (Brown.)

For Graduates

Bot. 200. Plant Biochemistry. (2)

First semester. Prerequisites, Bot. 101 and elementary organic chemistry, or equivalent. (Not offered 1959-1960; offered 1960-1961.) A study of the important substances in the composition of the plant body and the chemical changes occurring therein. (Galloway.)

Bot. 201. Plant Biochemistry Laboratory. (2)

First semester. Two laboratory periods a week. Prerequisite, Bot. 200 or concurrent registration therein. Laboratory fee, \$10.00. (Not offered 1959-1960; offered 1960-1961.) Application of apparatus and techniques to the study of the chemistry of plant materials. (Galloway.)

Bot. 202. Plant Biophysics. (2)

Second semester. Prerequisites, Bot. 1 and introductory physics, or equivalent. (Offered 1959-1960; not 1960-1961.) An advanced course dealing with the operation of physical phenomena in plant life processes. (Galloway.)

Bot. 203. Biophysical Methods. (2)

Second semester. Two laboratory periods a week. (Offered 1959-1960; not 1960-1961.) Laboratory course to accompany Bot. 202. Laboratory fee, \$10.00. (Staff.)

Bot. 204. Growth and Development. (2)

First semester. Prerequisite, 12 semester hours of plant science. (Offered 1959-1960; not 1960-1961.) A study of current developments in the mathematical treatment of growth and the effects of radiation, plant hormones, photoperiodism, and internal biochemical balance during the development of the plant. (Krauss.)

Bot. 205. Mineral Nutrition of Plants. (2)

Second semester. (Not offered 1959-1960; offered 1960-1961.) Reports on current literature are presented and discussed in connection with recent advances in the mineral nutrition of plants. (Gauch.)

Bot. 209. Physiology of Algae. (3)

First semester. (Offered 1959-1960; not 1960-1961.) Two lectures and one laboratory period a week. Prerequisite, Bot. 201, the equivalent in allied fields or permission of instructor. Laboratory fee, \$10.00. A study of the physiology and comparative biochemistry of the algae. Laboratory techniques and recent advances in algal nutrition, photosynthesis, and growth will be reviewed. (Staff.)

B. PLANT MORPHOLOGY, CYTOLOGY, AND TAXONOMY

*For Graduates and Advanced Undergraduates**Bot. 111. Plant Anatomy. (3)*

First semester. One lecture and two laboratory periods a week. Prerequisite, Bot. 110 or equivalent. Laboratory fee, \$5.00. The origin and development of the organs and tissue systems in the vascular plants. (Rappleye.)

Bot. 113. Plant Geography. (2)

First semester. Prerequisite, Bot. 1 or equivalent. A study of plant distribution throughout the world and the factors generally associated with such distribution. (Brown.)

Bot. 115. Structure of Economic Plants. (3)

Second semester. One lecture and two laboratory periods a week. (Offered 1959-1960; not 1960-1961.) Laboratory fee, \$5.00. A detailed microscopic study of the anatomy of the chief fruit and vegetable crops. (Rappleye.)

Bot. 116. History and Philosophy of Botany. (1)

Second semester. Prerequisite, 15 semester hours of botany. (Offered 1959-1960; not 1960-1961.) Discussion of the development of ideas and knowledge about plants, leading to a survey of contemporary work in botanical science. (Bamford.)

Bot. 117. General Plant Genetics. (2)

Second semester. Prerequisite, Bot. 1 or equivalent. The basic principles of plant genetics are presented; the mechanics of transmission of the hereditary factors in relation to the life cycle of seed plants, the genetics of specialized organs and tissues, spontaneous and induced mutations of basic and economic significance, gene action, genetic maps, the fundamentals of polyploidy, and genetics in relation to methods of plant breeding are the topics considered. (D. T. Morgan.)

Bot. 136. Plants and Mankind. (2)

First semester. A survey of the plants which are utilized by man, the diversity of such utilization, and their historic and economic significance. (Rappleye.)

Bot. 151S. Teaching Methods in Botany. (2)

Summer session. Five two-hour laboratory and demonstration periods a week. Prerequisite, Bot. 1, or equivalent. (Offered 1959 and in rotation thereafter.) Laboratory

fee, \$5.00. A study of the biological principles of the common plants, and demonstrations, projects, and visual aids suitable for teaching in primary and secondary schools. (Paterson.)

Bot. 153S. Field Botany. (2)

Summer session. Prerequisite, Bot. 1 or general biology. Offered in 1961 and in rotation with other courses thereafter. Laboratory fee, \$5.00. The identification of trees, shrubs, and herbs, emphasizing the native plants of Maryland. Manuals, keys, and other techniques will be used. Numerous short field trips will be taken. Each student will make an individual collection. (Brown.)

For Graduates

Bot. 211. Cytology. (4)

First semester. Two lectures and two laboratory periods a week. Prerequisite, introductory genetics. (Offered 1959-1960; not 1960-1961.) Laboratory fee, \$10.00. A detailed study of the chromosomes in mitosis and meiosis, and the relation of these to current theories of heredity and evolution. (D. T. Morgan.)

Bot. 212. Plant Morphology. (3)

Second semester. One lecture and two laboratory periods a week. Prerequisites, Bot. 11, Bot. 111, or equivalent. (Not offered 1959-1960; offered 1960-1961.) Laboratory fee, \$5.00. A comparative study of the morphology of the flowering plants, with special reference to the phylogeny and development of floral organs. (Rappleye.)

Bot. 215. Plant Cytogenetics. (3)

First semester. Two lectures and one laboratory period a week. Prerequisite, introductory genetics. (Offered 1959-1960; not 1960-1961.) Laboratory fee, \$10.00. An advanced study of the current status of plant genetics, particularly gene mutations and their relation to chromosome changes in corn and other favorable genetic materials. (D. T. Morgan.)

C. PLANT PATHOLOGY

For Graduates and Advanced Undergraduates

Bot. 122. Research Methods in Plant Pathology. (2)

First or second semester. Two laboratory periods a week. Prerequisite, Bot. 20, or equivalent. Laboratory fee, \$5.00. Advanced training in the basic research techniques and methods of plant pathology. (Wilson.)

Bot. 123. Diseases of Ornamentals. (2)

Second semester. Prerequisite, Bot. 20, or equivalent. (Offered 1959-1960; not 1960-1961.) Symptoms, control measures, and other pertinent information concerning the diseases which affect important ornamental plants grown in the eastern states. (Wilson.)

Bot. 124. Diseases of Tobacco and Agronomic Crops. (2)

First semester. Prerequisite, Bot. 20, or equivalent. (Not offered 1959-1960; offered 1960-1961.) The symptoms and control of the diseases of tobacco, forage crops, and cereal grains. (D. T. Morgan.)

Bot. 125. Diseases of Fruit Crops. (2)

First semester. Prerequisite, Bot. 20, or equivalent. (Offered 1959-1960; not 1960-1961.) Symptoms and control of the diseases affecting fruit production in the eastern United States. (Weaver.)

Bot. 126. Disease of Vegetable Crops. (2)

Second semester. Prerequisite, Bot. 20, or equivalent. (Not offered 1959-1960; offered 1960-1961.) The recognition and control of diseases affecting the production of important vegetable crops grown in the eastern United States. (Cox.)

Bot. 128. Mycology. (4)

Second semester. Two lectures and two laboratory periods a week. Prerequisite, Bot. 2, or equivalent. (Not offered 1959-1960; offered 1960-1961.) Laboratory fee, \$5.00. An introductory study of the morphology, classification, life histories, and economics of the fungi. (Wilson.)

Bot. 141. Nematode Disease of Plants. (2)

First semester. Prerequisite, Bot. 20 or permission of instructor. (Not offered 1959-1960; offered 1960-1961.) Designed to acquaint students in agricultural sciences with the role of nematodes as plant pathogens; study of representative diseases caused by nematodes; principles of practice and control. (Jenkins.)

Bot. 152S. Field Plant Pathology. (1)

Summer session. Daily lecture for three weeks. Prerequisite, Bot. 20 or equivalent. (Not offered 1959.) Laboratory fee, \$5.00. A course for county agents and teachers of vocational agriculture. Discussion and demonstration of the important diseases in Maryland crops. (Cox and Staff.)

*For Graduates**Bot. 221. Virus Diseases. (3)*

Second semester. Two lectures and one laboratory period a week. Prerequisites, Bot. 20 and Bot. 101. (Not offered 1959-1960; offered 1960-1961.) Laboratory fee, \$10.00. Consideration of the physical, chemical, and physiological aspects of plant viruses and plant diseases. (Sisler.)

Bot. 223. Physiology of Fungi. (2)

First semester. Prerequisites, Organic Chemistry and Bot. 101 or the equivalent in bacterial or animal physiology. (Not offered 1959-1960; offered 1960-1961.) A study of various aspects of fungal metabolism, nutrition, biochemical transformations, fungal products, and mechanism of fungicidal action. (Sisler.)

Bot. 224. Physiology of Fungi Laboratory. (1)

First semester. One laboratory period a week. Prerequisite, Bot. 223 or concurrent registration therein. (Not offered 1959-1960.) Laboratory fee, \$10.00. Application of equipment and techniques in the study of fungal physiology. (Sisler.)

Bot. 226. Plant Disease Control. (3)

First semester. Prerequisite, Bot. 20, or equivalent. (Offered 1959-1960; not 1960-1961.) An advanced course dealing with the theory and practices of plant disease control. (Cox.)

Bot. 241. Plant Nematology. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisite, permission of instructor. (Offered 1959-1960; not 1960-1961.) Laboratory fee, \$10.00. Detailed study of the nematodes parasitic on plants, their general morphology, taxonomy, reproduction, embryology, physiology, and ecology. Special emphasis will be given to recent advances in plant nematology. (Jenkins.)

Bot. 301. Special Problems in Botany. (2 or 3)

First or second semester. Credit according to time scheduled and organization of course. Maximum credit toward an advanced degree for the individual student at the discretion of the Department. This course may be organized as a lecture series on a specialized advanced topic, or may consist partly, or entirely, of experimental procedures. It may be taught by visiting lecturers, or by resident staff members. Problems or topics may be in physiology, ecology, pathology, mycology, nematology, cytology, cytogenetics, morphology, anatomy, or taxonomy. (Staff.)

Bot. 302. Seminar in Botany. (1)

First and second semesters. Prerequisite, permission of the instructor. Discussion of special topics and current literature in all phases of botany. (Staff.)

Bot. 399. Research. (Credit according to work done.)

A minimum of 6 credit hours is required for the M.S. degree, and an additional minimum of 12 hours is required for the Ph.D. degree. Students must be qualified to pursue with profit the research to be undertaken. (Staff.)

BUSINESS ADMINISTRATION

Professors: FREDERICK, CLEMENS, COOK, FISHER, GENTRY, PYLE, SWEENEY, SYLVESTER, TAFF, WEDEBERG AND WRIGHT.

Associate Professors: DAWSON AND MUELLER.

The degree of Master of Business Administration is conferred on those students who satisfactorily complete the requirements which are set forth in the section of this catalog entitled, "Requirements for the Degree of Master of Business Administration."

For Graduates and Advanced Undergraduates

B. A. 100. Office Operations and Management. (3)

Prerequisite, junior standing. Deals with the principles of scientific management as they apply to the examination, improvement, installation, and operation of the most effective paperwork methods and systems that a given organization can use to achieve its objectives. Procedure flow analysis and form design for control of paperwork; process, work distribution, and layout charts, distribution of authority and responsibility for office activities are among the areas considered.

B. A. 101. Integrated Data Processing for Internal Control. (3)

Prerequisite, junior standing. Laboratory fee, \$10.00. Comprises the bridge between accounting principles and the actualities of handling a large volume of data in modern business and government operations. Considers the measures necessary to marshal

accounting and other information for internal control and for service to management at all levels. The basic principles involved in the combining of accounting and recording machines through a keyboard "language" that is "understood" by other machines will be presented. Punched-card tabulating and punched-tape methods are studied. Graphic flow-chart methods are used to integrate these data-gathering techniques into normal accounting and reporting processes.

B. A. 102. Electronic Data Processing Systems. (3)

Prerequisite, B. A. 165, junior standing. Laboratory fee, \$10.00. The electronic digital computer and its use as a business data processor. The course includes the following areas: (1) Organization of business information; (2) Characteristics of commercially available equipment; (3) Flow charts; (4) Problems in reduction of processes to component parts; and (5) Programming typical internal control problems in business and government.

B. A. 103. Office Automation and Management Problems. (3)

Prerequisite, B. A. 114, or B. A. 165, or B. A. 168. Administrative problems experienced in introducing computer systems, feasibility studies, and the effect of office automation upon management and organization applied to case situations. Procedure distribution charts, flow diagrams, process charts, and other tools used by the methods analysts are developed in actual situations.

B. A. 110, 111. Intermediate Accounting. (3, 3)

First and second semesters. Prerequisite, a grade of "B" or better in B.A. 21 for majors in accounting or consent of instructor. A comprehensive study of the theory and problems of valuation of assets, application of funds, corporation accounts and statements, and the interpretation of accounting statements. (Staff.)

B. A. 116. Public Budgeting. (3)

Prerequisites, B.A. 21 and Econ. 32. A study of budgetary administration in the United States, including systems of financial control and accountability, the settlement of claims, centralized purchasing and the reporting of financial operations. (Wright.)

B. A. 118. Governmental Accounting. (3)

Prerequisite, B.A. 111, or consent of instructor. The content of this course covers the scope and functions of governmental accounting. It considers the principles generally applicable to all forms and types of governmental bodies and a basic procedure adaptable to all governments. (Wright.)

B. A. 121. Cost Accounting. (4)

Prerequisite, a grade of "B" or better in B.A. 21 for majors in accounting or consent of instructor. A study of the fundamental procedures of cost accounting, including those for job order, process and standard cost accounting systems. (Sweeney.)

B. A. 122. Auditing Theory and Practice. (3)

First semester. Prerequisite, B.A. 111. A study of the principles and problems of auditing and application of accounting principles to the preparation of audit working papers and reports. (Wright.)

B. A. 123. Income Tax Accounting. (4)

Prerequisite, a grade of "B" or better in B.A. 21 for majors in accounting, or consent

of instructor. A study of the important provisions of the Federal Tax Law, using illustrative examples, selected questions and problems, and the preparation of returns. (Wedeborg.)

B. A. 124, 126. *Advanced Accounting.* (3, 3)

First and second semesters. Prerequisite, B.A. 111. Advanced accounting theory applied to specialized problems in partnerships, estates and trusts, banks, mergers and consolidations, receiverships and liquidations; also budgeting and controllership. (Wedeborg.)

B. A. 125. *C.P.A. Problems.* (3)

Second semester. Prerequisite, B.A. 124, or consent of instructor. A study of the nature, form and content of C.P.A. examinations by means of the preparation of solutions to, and an analysis of, a large sample of C.P.A. problems covering the various accounting fields. (Wedeborg.)

B. A. 127. *Advanced Auditing Theory and Practice.* (3)

Second semester. Prerequisite, B.A. 122. Advanced auditing theory, practice and report writing. (Wright.)

B. A. 128. *Advanced Cost Accounting.* (2)

Prerequisite, B.A. 121. A continuation of basic cost accounting with special emphasis on process costs, standard costs, joint costs and by-product costs. (Sweeney.)

B. A. 130. *Elements of Business Statistics.* (3)

Prerequisite, junior standing. Required for graduation. Laboratory fee, \$3.50. An introductory course. Emphasis is placed upon statistical inference. Topics covered include statistical observation, frequency distributions, averages, measures of variability, elementary probability, sampling distributions, problems of estimation, simple tests of hypothesis, index numbers, time series, graphical and tabular presentation. Selected applications of the techniques are drawn from economics, industrial management, marketing and accounting. (Staff.)

B. A. 132. *Statistical Research and Control Techniques.* (3)

First semester. Prerequisite, B.A. 130. Laboratory fee, \$3.50. Review of elementary probability. Population distributions. Sampling distributions: binomial, Poisson, normal, "t", chi-square and F. Estimates and tests of hypotheses concerning the mean, variance and other parameters. Introduction to analysis of variance, linear regression and correlation. Introduction to quality control and acceptance sampling. (Nelson.)

B. A. 133. *Sample Surveys in Business and Economics.* (3)

Second semester. Prerequisite, B.A. 130. Laboratory fee, \$3.50. A general course in scientific sample survey techniques. Review of elementary probability, characteristics of good estimators, estimates and sampling variances for measurement data and attribute data, errors of observation, simple random sampling, cluster sampling, comparison of various sample designs, cost functions, examples of actual survey practices. (Nelson.)

B. A. 140. *Financial Management.* (3)

Prerequisites, B.A. 21 and Econ. 140. This course deals with principles and practices involved in the organization, financing, and rehabilitation of business enterprises; the various types of securities and their use in raising funds, apportioning income, risk,

and control; intercorporate relations; and new developments. Emphasis on solution of problems of financial policy faced by management. (Calhoun.)

B. A. 141. Investment Management. (3)

First semester. Prerequisite, B.A. 140. A study of the principles and methods used in the analysis, selection, and management of investments; investment programs, sources of investment information, security price movements, government, real estate, public utility, railroad, and industrial securities. (Calhoun.)

B. A. 142. Banking Policies and Practices. (3)

Second semester. Prerequisite, Econ. 140. A study of the organization and management of the Commercial Bank, the operation of its departments, and the methods used in the extension of commercial credit. (Calhoun.)

B. A. 143. Credit Management. (3)

First and second semesters. Prerequisite, B.A. 140. A study of the nature of credit and the principles applicable to its extension and redemption for mercantile and consumer purposes; sources of credit information and analysis of credit reports; the organization and management of a credit department for effective control. Recent developments and effective legal remedies available. (Calhoun.)

B. A. 148. Advanced Financial Management. (3)

Second semester. Prerequisite, B.A. 140. Advanced course designed for students specializing in finance. Emphasis is placed upon the techniques employed by executives in their application of financial management practice to selected problems and cases. Critical classroom analysis is brought to bear upon actual methods and techniques used by business enterprises. (Fisher.)

B. A. 149. Analysis of Financial Statements. (3)

Prerequisites, B.A. 21, B.A. 140. Analysis of financial statements for the guidance of executives, directors, stockholders, and creditors, valuation of balance sheet items; determination and interpretation of ratios. (Fisher.)

B. A. 150a. Marketing Principles and Organization. (3)

Prerequisite, Econ. 32 or 37. This is an introductory course in the field of marketing. Its purpose is to give a general understanding and appreciation of the forces operating, institutions employed, and methods followed in marketing agricultural products, natural products, services, and manufactured goods. (Staff.)

B. A. 150. Marketing Management. (3)

Prerequisite, B.A. 150a. A study of the work of the marketing division in a going organization. The work of developing organizations and procedures for the control of marketing activities are surveyed. The emphasis throughout the course is placed on the determination of policies, methods, and practices for the effective marketing of various forms of manufactured products. (Staff.)

B.A. 151. Advertising. (3)

First semester. Prerequisite, B.A. 150. A study of the role of advertising in the American economy; the impact of advertising on our economic and social life, the methods and techniques currently applied by advertising practitioners, the role of the

newspaper, magazine, and other media in the development of an advertising campaign, modern research methods to improve the effectiveness of advertising, and the organization of the advertising business. (Gentry.)

B. A. 152. *Advertising Copy and Layout.* (3)

Second semester. Prerequisites, B.A. 151, and senior standing. A study of the practices and techniques of copy writing and layout. The student will participate in exercises designed to teach him the essential principles of writing copy for various media and presenting ideas in visual form. The course deals with the development of ideas rather than art forms. (Gentry.)

B. A. 153. *Purchasing Management.* (3)

First semester. Prerequisites, B.A. 150 and senior standing. Retail store organization, determining the proper sources, quality and quantity of supplies, and methods of testing quality; price policies, price forecasting, forward buying, bidding and negotiation; budgets and standards of achievement. Particular attention is given to government purchasing and methods and procedures used in their procurement. (Gentry.)

B. A. 154. *Retail Store Management.* (3)

First semester. Prerequisites, B.A. 150 and senior standing. Retail store organization, location, layout and store policy; pricing policies, price lines, brands, credit policies, records as a guide to buying; purchasing methods; supervision of selling; training and supervision of retail sales force; and administrative problems. (Cook.)

B. A. 155. *Problems in Retail Merchandising.* (3)

Second semester. Prerequisite, B.A. 154. Designed to develop skill in the planning and control of merchandise stocks. Deals with buying policies, pricing, dollar and unit control procedures, mark-up and mark-down policies, merchandise budgeting, and the gross margin-expense-net earnings relationships. (Cook.)

B. A. 156. *Marketing Research Methods.* (3)

Second semester. Prerequisites, B.A. 130 and B.A. 150. This course is intended to develop skill in the use of scientific methods in the acquisition, analysis and interpretation of marketing data. It covers the specialized fields of marketing research, the planning of survey projects, sample design, tabulation procedure and report preparation. (Cook.)

B. A. 157. *Foreign Trade Procedure.* (3)

Prerequisites, B.A. 150 and senior standing. Functions of various exporting agencies; documents and procedures used in exporting and importing transactions. Methods of procuring goods in foreign countries; financing of import shipments; clearing through the customs districts; and distribution of goods in the United States. (Heye.)

B. A. 158. *Advertising Problems.* (3)

Second semester. Prerequisite, B.A. 151. This course is concerned with the way in which business firm's use advertising as a part of their marketing program. The case study method is used to present advertising problems taken from actual business practice. Cases studied illustrate problems in demand stimulation, media selection, advertising research, etc. (Gentry.)

B. A. 159. Newspaper Advertising. (3)

Second semester. Prerequisite, B.A. 151. A study of the problems of newspaper advertising with special attention to the needs of retail business. The course covers layout, production methods, sales techniques, and classified advertising. Students are encouraged to work in the advertising departments of campus and nearby publications for actual experience. (Gentry.)

B. A. 160. Personnel Management. (3)

Prerequisite, Econ. 160. This course deals with the problems of directing and supervising employees under modern industrial conditions. Two phases of personnel administration are stressed, the application of scientific management and the importance of human relations in this field. (Sylvester.)

B. A. 163. Industrial Relations. (3)

Second semester. Prerequisites, B.A. 160 and senior standing. A study of the development and methods of organized groups in industry with reference to the settlement of labor disputes. An economic and legal analysis of labor union and employer association activities, arbitration, mediation, and conciliation; collective bargaining, trade agreements, strikes, boycotts, lockouts, company unions, employee representation, and injunctions. (Sylvester.)

B. A. 164. Recent Labor Legislation and Court Decisions. (3)

First semester. Prerequisites, B.A. 160 and senior standing. Case method analysis of the modern law of industrial relations. Cases include the decisions of administrative agencies, courts and arbitration tribunals. (Sylvester.)

B. A. 166. Business Communications. (3)

First and second semesters. Prerequisite, junior standing. A systematic study of the principles of effective written communications in business. The fundamental aim is to develop the ability to write clear, correct, concise, and persuasive business letters and reports. (Patrick.)

B. A. 167. Job Evaluation and Merit Rating. (2)

First semester. Prerequisites, B.A. 160, B.A. 169 and senior standing. The investigation of the leading job evaluation plans used in industry, study of the development and administrative procedures, analyzing jobs and writing job descriptions, setting up a job evaluation plan, and relating job evaluation to pay scales. Study of various employee merit rating programs, the methods of merit rating, and the uses of merit rating. (Mueller.)

B. A. 169. Industrial Management. (3)

First and second semesters. Prerequisites, Econ. 160 and B.A. 11. Studies the operation of a manufacturing enterprise. Among the topics covered are product development, plant location, plant layout, production planning and control, methods analysis, time study, job analysis, budgetary control, standard costs, and problems of supervision. (Staff.)

B. A. 170. Transportation Services and Regulation. (3)

Prerequisite, Econ. 32 or 37. A general course covering the five fields of transportation, their development, service and regulation. (This course is a prerequisite for all other transportation courses.) (Taft.)

B. A. 171. *Industrial and Commercial Traffic Management.* (3)

Prerequisite, B.A. 170. Covers the details of classification and rate construction for ground and air transportation. Actual experiences in handling tariffs and classifications is provided. It is designed for students interested in the practical aspects of shipping and receiving and is required for all majors in Transportation Administration. (Taff.)

B. A. 172. *Motor Transportation.* (3)

First semester. Prerequisite, B.A. 170. The development and scope of the motor carrier industry, different types of carriers, economics of motor transportation, services available, federal regulation, highway financing, allocation of cost to highway users, highway barriers. (Taff.)

B. A. 172a. *Motor Carrier Administration.* (3)

Second semester. Prerequisites, B.A. 170 and 172. Over the road and terminal operations and management, the use of management controls, management organization, Interstate Commerce Commission policy as affecting management decisions. (Taff.)

B. A. 173. *Water Transportation.* (3)

Prerequisite, B.A. 170. Water carriers of all types, development and types of services, trade routes, inland waterways, company organization, the American Merchant Marine as a factor in national activity. (Heye.)

B. A. 174. *Commercial Air Transportation.* (3)

Prerequisite, B.A. 170. The air transportation system of the United States; airways, airports, airlines. Federal regulation of air transportation. Problems and services of commercial air transportation; economics, equipment, operations, financing, selling of passenger and cargo services. Air mail development and services. (Frederick.)

B. A. 175. *Airline Administration.* (3)

Prerequisite, B.A. 174. Practices, systems and methods of airline management; actual work in handling details and forms required in planning and directing maintenance, operations, accounting and traffic transactions, study of airline operations and other manuals of various companies. (Frederick.)

B. A. 176. *Problems in Airport Management.* (3)

Prerequisite, B.A. 174. Airports classified, aviation interests and community needs, airport planning, construction, building problems. Airports and the courts. Management, financing, operations, revenue sources. (Frederick.)

B. A. 177. *Motion Economy and Time Study.* (3)

Second semester. Prerequisites, B.A. 169 and senior standing. A study of the principles of motion economy, simo charts, micromotion study, the fundamentals of time study, job evaluation, observations, standard times, allowances, formula construction and wage payment plans. (Waterous.)

B. A. 178. *Production Planning and Control.* (2)

First semester. Prerequisites, B.A. 169 and senior standing. An analysis of the man-, material-, and machine requirements for production according to the several types of manufacture. The development and application of inventory records, load charts, production orders, schedules, production reports, progress reports and control reports. One lecture period and one laboratory period each week. (Mueller.)

B. A. 179. *Problems in Supervision.* (3)

Prerequisites, B.A. 160, B.A. 169 and senior standing. A case study course in problems of management and administration with emphasis upon analysis and reasoning applied toward a solution. (Mueller.)

B. A. 180, 181. *Business Law.* (4, 4)

First and second semesters. Prerequisite, senior standing. Required in all business organization curriculums. Legal aspects of business relationships, contracts, negotiable instruments, agency, partnerships, corporations, real and personal property, and sales. (Staff.)

B. A. 184. *Public Utilities.* (3)

Prerequisites Econ. 32 or 37 and senior standing. Using the regulated industries as specific examples attention is focused on broad and general problems in such diverse fields as constitutional law, administrative law, public administration, government control of business, advanced economic theory, accounting, valuation and depreciation, taxation, finance, engineering and management. (Clemens.)

B. A. 189. *Business and Government.* (3)

Second semester. Prerequisites, Econ. 32 or 37 and senior standing. A study of the role of government in modern economic life. Social control of business as a remedy for the abuses of business enterprise arising from the decline of competition. Criteria of and limitations on government regulation of private enterprise. (Clemens.)

B. A. 190. *Life Insurance.* (3)

First semester. Prerequisite, Econ. 32 or 37. A general survey of life insurance: Its institutional development, selection of risks, mathematical calculations, contract provision, kinds of policies, their functional uses, industrial and group contracts and government supervision. (Clickner.)

B. A. 191. *Property Insurance.* (3)

Second semester. Prerequisite, Econ. 32 or 37. A study of the insurance coverages written to protect individuals and businesses; fire, extended coverage, business interruption, automobile, liability, fidelity, surety, inland marine and ocean marine. Hazards, rate-making, legal principles, standard forms and business practices are discussed. (Clickner.)

B. A. 195. *Real Estate Principles.* (3)

First semester. Prerequisite, Econ. 32 or 37. This course covers the nature and uses of real estate, real estate as a business, basic legal principles, construction problems and home ownership, city planning, and public control and ownership of real estate. (Clickner.)

B. A. 196. *Real Estate Finance.* (3)

Second semester. Prerequisite, Econ. 32 or 37. This course includes consideration of the factors influencing real estate values, methods and techniques in the general appraisal of real estate by brokers and professional appraisers, and general problems in real estate financing. (Clickner.)

For Graduates

- B. A. 210. *Advanced Accounting Theory*. (2, 3)
Prerequisite, B. A. 111. (Wedeborg, Fisher.)
- B. A. 220. *Managerial Accounting*. (3)
(Wedeborg, Wright.)
- B. A. 221, 222. *Seminar in Accounting*.
(Wedeborg, Wright.)
- B. A. 226. *Accounting Systems*.
(Wedeborg, Sweeney.)
- B. A. 228. *Research in Accounting*.
(Wedeborg.)
- B. A. 229. *Studies of Special Problems in the Fields of Control and Organization*.
(Mueller.)
- B. A. 240. *Seminar in Financial Management*. (1-3)
Prerequisite, B. A. 140. (Fisher.)
- B. A. 249. *Studies of Special Problems in the Field of Financial Administration*.
(Fisher.)
- B. A. 250. *Problems in Sales Management*. (1-3)
(Cook, Reid.)
- B. A. 251. *Problems in Advertising*. (3)
(Gentry.)
- B. A. 252. *Problems in Retail Store Management*. (3)
(Cook.)
- B. A. 257. *Seminar in Marketing Management*.
(Cook, Gentry, Reid.)
- B. A. 258. *Research in Marketing*.
(Cook, Gentry.)
- B. A. 262. *Seminar in Contemporary Trends in Labor Relations*. (3)
(Sylvester.)
- B. A. 265. *Development and Trends in Industrial Management*. (3)
(Mueller.)
- B. A. 266. *Research in Personnel Management*.
(Sylvester.)
- B. A. 267. *Research in Industrial Relations*.
(Sylvester.)
- B. A. 269. *Studies of Special Problems in Employer-Employee Relationships*.
(Sylvester.)
- B. A. 270. *Seminar in Air Transportation*. (3)
(Frederick.)
- B. A. 271. *Theory of Organization*. (3)
(Mueller.)

- B. A. 275. *Seminar in Motor Transportation.* (3) (Taff.)
 B. A. 277. *Seminar in Transportation.* (3) (Frederick.)
 B. A. 280. *Seminar in Business and Government Relationships.* (Staff.)
 B. A. 284. *Seminar in Public Utilities.* (3) (Clemens.)
 B. A. 399. *Thesis Research.* (Staff.)

CHEMICAL ENGINEERING

Professors: HUFF, BONNEY, PENNINGTON AND SCHROEDER.

Associate Professors: DUFFEY AND SILVERMAN.

This Department directs the programs of graduate students who plan to qualify for the degree of Master of Science or Doctor of Philosophy in Chemical Engineering, Nuclear Engineering or in Metallurgy.

Departmental regulations have been assembled for the guidance of candidates for graduate degrees in Chemical Engineering and in the Metallurgical Option. Copies of these regulations are available on request from the Department of Chemical Engineering.

For Graduates and Advanced Undergraduates

Ch. E. 103, f, s. *Elements of Chemical Engineering.* (3, 3)

First and second semesters. Three hours a week. Prerequisites, Chem. 3, Math. 21, Phys. 21. Theoretical discussion of underlying philosophy and methods in chemical engineering and elementary treatment of important operations involving fluid flow, heat flow, evaporation, humidity and air conditioning, distillation, absorption, extraction, and filtration. Illustrated by problems and consideration of typical processes. (Huff.)

Ch. E. 104. *Chemical Engineering Seminar.* (1)

Both semesters. One hour a week. Prerequisite, permission of the Department of Chemical Engineering. The content of this course is constantly changing so a student may receive a number of credits by re-registration. Students prepare reports on current problems in chemical engineering and participate in the discussion of such reports.

Ch. E. 105, f, s. *Advanced Unit Operation.* (5, 5)

Two lectures and one all-day laboratory a week. Prerequisites, Ch. E. 103, f,s, Chem. 189, 190. Laboratory fee, \$8.00 per semester. Advanced theoretical treatment of basic chemical engineering operations. Study and laboratory operation of small scale semi-commercial type equipment. A comprehensive problem involving theory and laboratory operations is included to illustrate the development of a plant design requiring the utilization of a number of fundamental topics. (Bonney and Staff.)

Ch. E. 106, f, s. *Minor Problems.* (6, 6)

Laboratory fee, \$8.00 per semester.

(Staff.)

Chemical Engineering

Ch. E. 107. *Fuels and Their Utilization.* (3)

Second semester. Three hours a week. Prerequisites, Ch. E. 103, f,s, or permission of Department of Chemical Engineering. A study of the sources of solid, liquid, and gaseous fuels, their economic conversion, distribution, and utilization. Problems. (Huff.)

Ch. E. 109, f, s. *Chemical Engineering Thermodynamics.* (3, 3)

Three hours a week. Prerequisites, Chem. 187, 189, Ch. E. 103, f,s, or permission of instructor. A study of the application of the principles of engineering and chemical thermodynamics to some industrial problems encountered in the practice of chemical engineering. (Bonney.)

Ch. E. 112, 113. *Industrial Chemical Technology.* (3, 3)

Three hours a week. Prerequisites, Ch. E. 103, or simultaneous registration therein, or permission of the Department of Chemical Engineering. A study of the major chemical processes and industries combined with quantitative analysis of process requirements and yields. Plant inspection trips, reports, and problems. (Schroeder.)

Ch. E. 114. *Applications of Electrochemistry.* (4)

Laboratory fee, \$8.00.

(Staff.)

Ch. E. 116. *Applied Mathematics in Chemical Engineering I.* (3)

First semester. Three lectures a week. Prerequisites, Math. 20, 21 and Ch. E. 103. A study of methods for analysis and solution of chemical engineering problems by use of differential equations. Graphical, numerical and statistical methods and approximations by use of infinite series are covered. (Staff.)

Ch. E. 117. *Applied Mathematics in Chemical Engineering II.* (3)

Second semester. Three lectures a week. Prerequisites, Ch.E. 116 or equivalent. Material covered includes formulation and solution of partial differential equations that arise in chemical engineering problems. Solution of chemical engineering problems by the calculus of finite differences, and numerical solution of partial differential equations are covered. (Staff.)

Ch. E. 123. *Elements of Plant Design.* (3)

Two lectures and one laboratory period a week. Prerequisites, Ch.E. 103, Ch.E. 116, Chem. 189. The solution of typical problems encountered in the design of chemical engineering plants. (Schroeder.)

Ch. E. 131. *Chemical Engineering Economics.* (2)

Second semester. Two lectures a week. Prerequisites, simultaneous registration in or completion of Ch.E. 112, 113, 109, and 123, or permission of instructor. Economic evaluation of chemical processes. Determination of investment and operating costs for chemical engineering plants. Effect of risk and taxation on profits from such plants. (Schroeder.)

Ch. E. 145. *Applications of Differential Equations and Statistics in Chemical Engineering.* (3)

Second semester. One lecture, two laboratory periods per week. Prerequisites, Ch.E. 103, Ch.E. 116, or permission of the instructor. (Staff.)

For Graduates

Ch. E. 201. Graduate Unit Operations. (5)

First semester. One hour conference, three or more laboratory periods a week. Prerequisite, permission of the Department of Chemical Engineering. Laboratory fee, \$8.00. Advanced theoretical treatment of typical unit operations in chemical engineering. Problems. Laboratory operation of small scale semi-commercial units with supplemental reading, conferences and reports. (Bonney.)

Ch. E. 202. Gas Analysis. (3)

One lecture and two laboratory periods a week. One semester. Prerequisite, permission of the Department of Chemical Engineering. Laboratory fee, \$8.00. Quantitative determination of common gases, fuel gases, gaseous vapors, and important gaseous impurities. Problems. (Bonney.)

Ch. E. 203. Graduate Seminar. (1)

One hour a week. Required of all graduate students in chemical engineering. The content of this course is constantly changing so a student may receive a number of credits by re-registration. Students prepare reports on current problems in chemical engineering and participate in the discussion of such reports. (Huff.)

Ch. E. 207; f, s. Advanced Plant Design Studies. (3, 3)

Three conference hours a week. Prerequisite, permission of the Department of Chemical Engineering. (Huff, Schroeder.)

Ch. E. 209, f, s. Plant Design Studies Laboratory. (3, 3)

Three laboratory periods a week. Prerequisite, permission of the Department of Chemical Engineering. Laboratory fee, \$8.00 per semester. (Bonney.)

Ch. E. 210, f, s. Gaseous Fuels. (2, 2)

Two hours a week. Prerequisite, permission of the Department of Chemical Engineering. An advanced treatment of some of the underlying scientific principles involved in the production, transmission and utilization of gaseous fuels. Problems in design and selection of equipment. (Huff.)

Ch. E. 214, f, s. Corrosion and Metal Protection. (4)

Four lecture hours a week. Prerequisite, Ch.E. 114 or Chem. 189 or Chem. 190 or consent of the instructor. The subjects to be covered include: theories of corrosion of ferrous and nonferrous metals, passive films, corrosion inhibitors, metal cleaning, stress corrosion, corrosive chemicals, electrolytic protection, restoration of ancient bronzes, organic coatings, metal coloring, parkerizing, hot dip coatings, plated coatings, and selection of engineering materials. Class demonstrations will illustrate the subject matter. Due to the diversity of subjects and scattered sources, considerable outside reading will be necessary. (Huff.)

Ch. E. 216. Unit Processes of Organic Technology. (3)

Second semester. Three lectures a week. Prerequisite, permission of the Department of Chemical Engineering. This course coordinates the study of fundamental principles of organic synthesis with the requirements of the industrial plant. (Bonney.)

Nuclear Engineering

Ch. E. 217. Unit Processes of Organic Technology Laboratory. (2)

Second semester. Two or more laboratory periods a week. Prerequisite, permission of the Department of Chemical Engineering. Laboratory fee, \$8.00 per semester. Pilot plant operation of processes such as halogenation, hydration, nitration, oxidation, reduction and sulfonation. (Bonney.)

Ch. E. 240, 241. Advanced Heat and Mass Transfer. (3, 3)

First and second semesters. Elective of graduate students in chemical engineering and others. Prerequisite, permission of the Department of Chemical Engineering. The technical and scientific elements of the mathematical theory of heat and mass transfer. (Staff.)

Ch. E. 250. Chemical Engineering Practice. (6)

Four hours conference and forty hours a week of work in laboratory and plant for eight weeks. Prerequisite, permission of the Department of Chemical Engineering. (Staff.)

Ch. E. 280, 281. Graduate Chemical Engineering Thermodynamics. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Ch.E. 109, Ch.E. 116, or permission of instructor. Advanced studies of the applications of the principles of engineering and chemical thermodynamics to some industrial problems encountered in the practice of chemical engineering. (Bonney.)

Ch. E. 290. Chemical Engineering Process Kinetics. (3)

First semester. Three lectures a week. Prerequisites, permission of instructor. Methods of application of kinetic data to the design of reactors for industrially important processes are illustrated by solution of typical problems. Treatments for both homogeneous and heterogeneous reactions are given. (Staff.)

Ch. E. 399. Research in Chemical Engineering.

Credit hours to be arranged. Laboratory fee, \$8.00 per semester. The investigation of special problems and the preparation of a thesis in partial fulfillment of the requirements of an advanced degree. (Huff, Bonney, Schroeder, Duffey.)

NUCLEAR ENGINEERING COURSES

For Graduates and Advanced Undergraduates

Ch. E. 140. Introduction to Nuclear Technology. (2)

First semester. Two lectures a week. Prerequisites, Math. 21 and Phys. 21. Engineering description of the different parts of the atomic energy complex, including mining and refining of ores, isotopic and chemical separations and nuclear reactor operation. The novel chemical engineering techniques employed are discussed. The emphasis is on the nuclear reactor. This is an orientation course for those only generally interested in applied atomic energy. (Duffey.)

Ch. E. 142. Environmental Consideration of Nuclear Engineering. (3)

First semester. Three lectures a week. Prerequisite, permission of instructor. Engineering analysis of protection of the public and the environment from the hazards of nuclear

energy operations. Emphasis is on the handling and disposal of gaseous, liquid and solid radioactive wastes. Meteorological, hydrological and geological phases are included. Typical problems encountered from mining of ores through nuclear reactor operations and chemical separations are considered. Legislative and economic factors, site selection, plant design and operation as related to the environment are discussed.

(Lieberman.)

Ch. E. 148. Nuclear Technology Laboratory. (3)

One lecture, two laboratory periods a week. Prerequisites, Chem. 3, Phys. 21, Math. 21, Ch.E. 140 or equivalents and permission of instructor. Laboratory fee, \$8.00 per semester. Laboratory operations of equipment demonstrating techniques of handling and making measurements with radioactive materials in the nuclear industry. Health physics experiments are included.

(Duffey and Bonney.)

For Graduates

Ch. E. 301. Seminar in Nuclear Engineering. (1)

First and second semesters. One meeting a week. Survey of nuclear engineering literature, and oral presentation of prepared reports. Since the content of this course is changing, a student may receive a number of credits by re-registration.

(Duffey.)

Ch. E. 302, 303. Nuclear Reactor Engineering. (3, 3)

First and second semesters. Three lectures a week. Prerequisite, permission of instructor. Introduction to the engineering problems of the design, construction and operation of typical nuclear reactors, including general design, nuclear reactor theory, materials of construction, heat transfer, control, etc. Emphasis is toward commercial nuclear reactors.

(Duffey.)

Ch. E. 305. Sub-critical Nuclear Reactor Laboratory. (3)

One lecture, two laboratory periods a week. Prerequisites, Ch.E. 148, 302, 303, or equivalents, and permission of instructor. Laboratory fee, \$8.00 per semester. Experimental work with the subcritical nuclear reactor. The appropriate radiation detection equipment is used. Experiments, such as infinite multiplication factors, lattice amplification, temperature coefficients, fission product studies, neutron flux distribution in the lattice, and neutron activation are carried out.

(Duffey and Bonney.)

Ch. E. 311. Nuclear Separation Engineering. (2)

Second semester. Two lectures a week. Prerequisite, permission of instructor. Application of chemical engineering to the chemical and isotopic separations necessary for nuclear reactor operation. These separations include (1) processing of uranium, thorium and other ores, (2) chemical separation of plutonium, uranium, fission products and other elements from materials irradiated in nuclear reactors, (3) treatment and disposal of radioactive wastes, (4) isotopic separation of U235 and heavy water.

(Duffey.)

Ch. E. 313. Selected Topics in Nuclear Engineering. (2)

Two lectures a week. Prerequisite, permission of instructor. Topics of current interest and recent advances in the nuclear engineering field. Because of declassification and the rapid advances in the field, information on special topics of much practical importance is continually becoming available. Such information will be presented in this course. Since the content changes, re-registration may be permitted.

(Duffey.)

Metallurgical Option

Ch. E. 314. Special Problems in Nuclear Engineering.

Credit hours to be arranged. Prerequisite, consent of instructor. Research or special study. This is for individual projects on a graduate level. Laboratory fee, \$10.00 per semester. (Duffey.)

Ch. E. 315. Non-Power Uses of Nuclear or High Energy Radiation. (2)

Second semester. Two lectures a week. Prerequisite, permission of instructor. An engineering survey of the current applications and those under development. Included are such uses of radiation as synthesizing chemicals, preserving foods, measurement of density and thickness of materials, and tracing of industrial processes. Design of irradiation installations, e.g., cobalt 60 gamma ray sources, electronuclear machine arrangements, and specially built nuclear reactors are considered. (Duffey.)

Ch. E. 399. Research in Nuclear Engineering.

Credit hours to be arranged. The investigation of special problems and the preparation of a thesis in partial fulfillment of the requirements of an advanced degree. Laboratory fee, \$8.00 per semester. (Duffey.)

METALLURGICAL OPTION

For Graduates and Advanced Undergraduates

Met. 104. Senior Metallurgical Seminar. (1)

One hour a week. Students prepare reports on current problems in metallurgy and participate in the discussion of such reports. The content of this course is constantly changing so a student may receive a number of credits by re-registration. (McWilliams.)

Met. 150, 151. Physical Metallurgy. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Math. 21 and Phys. 21. States of matter, physical structure of gases, liquids and solids; physical structure and constitution of metals; properties as related to atomic structures; x-ray and crystal structure effect of mechanical working, heat treatment and composition; constitution and properties of alloy systems; phase transformation and diffusion theory; casting, shaping, welding, and testing metal objects. (Pennington.)

Met. 152, 153. Physical Metallurgy Laboratory. (2, 2)

First and second semesters. Two three hour laboratories per week. Prerequisites, Math. 21, Phys. 21, Met. 150, 151 (may be taken concurrently). Laboratory fee, \$8.00 per semester. These courses are associated with Met. 150, 151, but are not required with the lecture courses except in the case of metallurgy majors. (Pennington.)

Met. 164, 166. Thermodynamics of Metallurgical Processes. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Chem. 187, 189; Chem. 188, 190. The application of the principles of thermodynamics to metallurgical systems with emphasis on steel making; laws of chemical reactions; materials and reactions in steel making processes; applications of theory to steel making; applications of theory to selected nonferrous systems. (Pennington.)

Met. 168, 170. Metallurgical Investigations. (2, 4)

First semester. Two three-hour laboratory periods a week. Second semester. Three lectures and one three-hour laboratory period a week. Prerequisites, concurrent registration in or completion of Met. 182, 183. Laboratory fee, \$8.00 per semester. A study of the basic metals industry in which typical metallurgical processes in plant installations are considered in some detail. Class and individual assignments involving laboratory work and literature reviews. (Pennington.)

Met. 172. Light Metals and Alloys. (2)

First semester. Two lectures a week. Prerequisites, Met. 150, 151. The physical metallurgy of aluminum, magnesium, titanium, and their alloys. Discussion of the classic researches that have determined the course of thinking regarding such metals and alloys. Pertinent phase diagrams of industrial importance to light alloys. The special metallurgical processes influencing the fabrication and use of light metals. (Pennington.)

Met. 182, 183. Optical and X-Ray Metallography. (4, 4)

First and second semesters. Three lectures and one laboratory period a week. Prerequisites, Met. 150, 151, or permission of instructor. The application at an advanced level of the principles of metallography, with emphasis on the correlation of associated test procedures; constitution of metal systems and phase transformations; alloy steels; hardenability and tempering of quenched steels. Laboratory fee, \$8.00 per semester. (Park.)

Met. 188, 189. Alloy Steels I, II. (2, 2)

First and second semesters. Two lectures per week. Prerequisites, graduate or undergraduate standing. (Met. 188 is not prerequisite to Met. 189.) Recent advances in the physical metallurgy of steel; ferrite, cementite, and austenite; the isothermal transformation of austenite; decomposition of austenite by continuous cooling; the effects of various metallurgical treatments on the mechanical properties of steels. The properties of quenched and tempered steels; importance of hardenability in engineering applications; calculation of hardenability; variables affecting hardenability; intensifiers; effects of alloying elements on the mechanical properties of steels; efficient use of alloying elements in steel. (Note: To be offered at off-campus installations as determined by departmental and registration requirements.) (Loring.)

For Graduates

Met. 220, 221. Solid Phase Reactions. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Chem. 187, 189; Chem. 188, 190; Met. 182, 183; or permission of instructor. The application of thermodynamics to the study of phase equilibria and transformations in metals; mechanism and rate determining factors in solid phase reactions in metals; order-disorder phenomena, diffusion processes, nucleation theory, precipitation from solid solution, eutectoid decomposition. (Moore.)

Met. 224, 225. Advanced X-Ray Metallography. (3, 3)

First and second semesters. Two lectures and one laboratory period a week. Prerequisites, Math. 114, 115; Met. 182, 183. Laboratory fee, \$8.00 per semester. Analysis of crystallography or martensite reactions, and transformations in general; analysis of complex diffracting systems.

Metallurgical Option

Met. 228. Seminar in Metallurgy. (1)

First and second semesters. One meeting a week. Required of graduate students in metallurgical curriculum. Survey of metals literature, and oral presentation of prepared reports. The content of this course is constantly changing, so a student may receive a number of credits by re-registration. (Pennington.)

Met. 229. Gases in Metals. (2)

Second semester. Two lectures per week. Prerequisites, Met. 182, 183, or permission of the instructor. A consideration of the behavior of gases in metals with emphasis on the action of hydrogen in solid metals. (Pennington.)

Met. 230, 231. Mechanical Metallurgy. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Math. 114, 115; Met. 182, 183. Theory of plastic flow and rupture of polycrystalline metals; the influence of combined stresses, rate of deformation and temperature variation on the flow and rupture of metals. Flow and fracture in single crystals; theoretical crystal plasticity, theory of failure, recovery, recrystallization, and texture formation. (Moore.)

Met. 232, 233. Advanced Physical Metallurgy. (3, 3)

First and second semesters. Three lectures a week. Required of graduate students in metallurgical curriculum. The principles of X-ray metallography; the atomic theory of metals; magnetic materials; phase equilibria; review of important binary and ternary systems; diffusion and transformations in the solid state. (Offered off-campus.) (Loring.)

Met. 238. Metallurgy of Nuclear Reactor Materials I. (2)

First semester. Two lectures a week. Prerequisites, Met. 150-151. Theory and practice relating to metals such as uranium, thorium, and plutonium. The preparation of such metals in their purest state for use in nuclear reactors. The physical, metallurgical and mechanical characteristics of fissionable metals, their melting, casting, fabrication, and heat treatment. The alloys of uranium, thorium, and plutonium. Theoretical considerations and precautions in their preparation, investigation and use. Discussion of phase diagrams of nuclear alloy systems. (Loring.)

Met. 239. Metallurgy of Nuclear Reactor Materials II. (2)

Second semester. Two lectures a week. Prerequisite, Met. 238. Theory and practice of nuclear metals used in reactors including structural materials such as beryllium and zirconium, and metals used for transfer of heat such as sodium, bismuth, and various low melting alloys. Discussion of pertinent phase diagrams. Radiation damage, mass transfer, and other specialized effects. (Loring.)

Met. 399. Research in Metallurgy.

Credit hours to be arranged. Laboratory fee, \$8.00 per semester. The investigation of special problems and the preparation of a thesis in partial fulfillment of the requirements of an advanced degree. (Pennington.)

CHEMISTRY

Professors: DRAKE, LIPPINCOTT, PRATT, REEVE, ROLLINSON, SVIRBELY, VEITCH, WHITE AND WOODS.

Research Professor: BAILEY.

Associate Professors: BROWN, JANSEN*, MASON*, PICKARD, SCHAMP* AND STUNTZ.

Assistant Professors: DEWEY, JAQUITH, MAISCH, PURDY AND VANDERSLICE*.

Departmental regulations have been assembled for the guidance of candidates for graduate degrees. Copies of these regulations are available from the Department of Chemistry.

Laboratory fees in Chemistry are \$10.00 per laboratory course per semester, except Chemistry 214 which is \$20.00.

A. ANALYTICAL CHEMISTRY

*For Graduates and Advanced Undergraduates**Chem. 123. Quantitative Analysis. (4)*

First semester. Two lectures and two three-hour laboratory periods per week. Prerequisite, Chem. 21 or equivalent. An intensive study of the theory and techniques of inorganic quantitative analysis, including volumetric, gravimetric, electrometric and colorimetric methods. Required of all students majoring in chemistry. (Stuntz.)

Chem. 166, 167. Food Analysis. (3, 3)

First and second semesters. One lecture and two three-hour laboratory periods per week. Prerequisites, Chem. 33, 34. (Staff.)

*For Graduates**Chem. 206, 208. Spectrographic Analysis. (1, 1)*

One three-hour laboratory a week. Prerequisite, Chem. 188, 190, and consent of the instructor. Registration limited. (White.)

Chem. 221, 223. Chemical Microscopy. (2, 2)

First and second semesters. One lecture and one three-hour laboratory period a week. Prerequisite, consent of instructor. Registration limited. A study of the construction and optics of the microscope and its applications in chemistry, with particular emphasis on the optical properties of crystals. (Stuntz.)

Chem. 226, 228. Advanced Quantitative Analysis. (2, 2)

First and second semesters. Two three-hour laboratory periods a week. Prerequisite, consent of instructor. A study of advanced methods chosen to meet the needs and interests of the individual. (Stuntz.)

*Members of Institute of Molecular Physics.

Chemistry

Chem. 266. *Biological Analysis.* (2)

Second semester. Two three-hour laboratory periods per week. Prerequisites, Chem. 19, 33, 34. A study of analytical methods applied to biological material. (Staff.)

B. BIOCHEMISTRY

For Graduates and Advanced Undergraduates

Chem. 161, 163. *Biochemistry.* (2, 2)

First and second semesters. Two lectures a week. Prerequisite, Chem. 33, or Chem. 37. (Woods, Veitch.)

Chem. 162, 164. *Biochemistry Laboratory.* (2, 2)

First and second semesters. Two three-hour laboratory periods a week. Prerequisite, Chem. 34, or Chem. 38. (Woods, Veitch.)

For Graduates

Chem. 261, 263. *Advanced Biochemistry.* (2, 2)

First and second semesters. Two lectures a week. Prerequisite, Chem. 143 or consent of instructor. (Veitch.)

Chem. 262, 264. *Advanced Biochemistry Laboratory.* (2, 2)

First and second semesters. Two three-hour laboratory periods a week. Prerequisite, consent of the instructor. (Veitch.)

Chem. 265. *Enzymes.* (2)

First semester. Two lectures a week. Prerequisite, Chem. 163. (Veitch.)

Chem. 268. *Special Problems in Biochemistry.* (2-4)

First and second semesters. Two to four three-hour laboratory periods a week. Prerequisites, Chem. 161, 162, 163, 164, and consent of the instructor. (Veitch.)

C. INORGANIC CHEMISTRY

For Graduates and Advanced Undergraduates

Chem. 101. *Advanced Inorganic Chemistry.* (2)

Second semester. Two lectures a week. Prerequisites, Chem. 37, 123. (Staff.)

Chem. 102. *Inorganic Preparations.* (2)

Second semester. Two three-hour laboratory periods per week. Prerequisite, Chem. 123. (Jaquith.)

Chem. 111. *Chemical Principles.* (4)

Two lectures and two three-hour laboratory periods a week. Prerequisites, Chem. 1 and 3, or equivalent. Not open to students seeking a major in the physical sciences, since the course content is covered elsewhere in their curricula. A course in the principles of chemistry with accompanying laboratory work consisting of simple quantitative experiments. (Credit applicable only toward degree in College of Education.) (Jaquith.)

For Graduates

- Chem. 201, 203. The Chemistry of the Rarer Elements. (2, 2)*
First and second semesters. Two lectures a week (White.)
- Chem. 202, 204. Advanced Inorganic Laboratory. (2)*
First and second semesters. Two three-hour laboratory periods a week. (Staff.)
- Chem. 205. Radiochemistry. (2)*
Two lectures a week. (Rollinson.)
- Chem. 207. Chemistry of Coordination Compounds. (2)*
Two lectures a week. (Rollinson.)
- Chem. 209. Non-aqueous Inorganic Solvents. (2)*
First or second semester. Two lectures a week. (Jaquith.)
- Chem. 210. Radiochemistry Laboratory. (1 or 2)*
One or two four-hour laboratory periods a week. Registration limited. Prerequisites, Chem. 205 (or concurrent registration therein) and consent of instructor. (Lakshmanan.)
- Chem. 211. Selected Topics in Inorganic Chemistry. (2)*
First or second semester. Two lectures a week. Prerequisites, Chem. 201, 203 or equivalent. An examination of some current topics in modern inorganic chemistry. (Boyd.)
- Chem. 213. Advanced Radiochemistry. (2)*
Second semester. Two lectures per week. Prerequisite, Chem. 205 or consent of instructor. Utilization of radioisotopes with special emphasis on applications to problems in the life sciences. (Lakshmanan.)
- Chem. 214. Advanced Radiochemistry Laboratory. (1 or 2)*
Second semester. One or two four-hour laboratory periods per week. Prerequisites, Chem. 210 and Chem. 213 (or concurrent registration in Chem. 213) and consent of instructor. Registration limited. Laboratory training in utilization of radioisotopes with special emphasis on applications to problems in life sciences. (Lakshmanan.)

D. ORGANIC CHEMISTRY

For Graduates and Advanced Undergraduates

- Chem. 141, 143. Advanced Organic Chemistry. (2, 2)*
First and second semesters. Two lectures a week. Prerequisites, Chem. 37, 38. An advanced study of the compounds of carbon. (Reeve.)
- Chem. 144. Advanced Organic Laboratory. (2-4)*
First and second semesters. Two three-hour laboratory periods a week. Prerequisites, Chem. 37, 38. (Pratt.)

Chemistry

Chem. 146, 148. The Identification of Organic Compounds. (2, 2)

First and second semesters. Two three-hour laboratory periods a week. Prerequisites, Chem. 141, 143, or concurrent registration therein. The systematic identification of organic compounds. (Pratt.)

Chem. 150. Organic Quantitative Analysis. (2)

First and second semesters. Two three-hour laboratory periods per week. Prerequisite, consent of instructor. The semi-micro determination of carbon, hydrogen, nitrogen, halogen and certain functional groups.

This course may be substituted for Chem. 144 in the chemistry major curriculum. (Gerdeman.)

For Graduates

(One or more courses from the following group 241-254 will customarily be offered each semester. Two of these courses will be presented in the academic year 1959-1960.)

Chem. 240. Organic Chemistry of High Polymers. (2)

First semester. Two lectures a week. Prerequisites, Chem. 141, 143. An advanced course covering the synthesis of monomers, mechanism of polymerization, and the correlation between structure and properties in high polymers. Prerequisites, Chem. 141 and 143. (Bailey.)

Chem. 241. Stereochemistry. (2)

Two lectures a week. (Woods.)

Chem. 245. The Chemistry of the Steroids. (2)

Two lectures a week. (Pratt.)

Chem. 249. Physical Aspects of Organic Chemistry. (2)

Two lectures a week. (Woods.)

Chem. 251. The Heterocyclics. (2)

Two lectures a week. (Pratt.)

Chem. 253. Organic Sulfur Compounds. (2)

Two lectures a week. (Dewey.)

Chem. 254. Advanced Organic Preparations. (2-4)

First and second semesters. Two or four three-hour laboratory periods a week. (Pratt.)

Chem. 258. The Identification of Organic Compounds, an Advanced Course. (2-4)

First and second semesters. Two to four three-hour laboratory periods a week. Prerequisites, Chem. 141, 143, or concurrent registration therein. (Pratt.)

E. PHYSICAL CHEMISTRY

*For Graduates and Advanced Undergraduates**Chem. 181, 183. Elements of Physical Chemistry. (2, 2)*

First and second semesters. Two lectures a week. Prerequisites, Chem. 19; Phys. 10, 11; Math. 10, 11. (Brown.)

Chem. 182, 184. Elements of Physical Chemistry Laboratory. (1, 1)

First and second semesters. One three-hour laboratory period a week. May be taken ONLY when accompanied by Chem. 181, 183. (Brown.)

Chem. 187, 189. Physical Chemistry. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Chem. 19 or 21; Phys. 20, 21; Math. 20, 21. This course must be accompanied by Chem. 188, 190, unless excused by the instructor. (Svirbely.)

Chem. 188, 190. Physical Chemistry Laboratory. (2, 2)

First and second semesters. Two three-hour laboratory periods a week. A laboratory course for students taking Chem. 187, 189. (Pickard.)

Chem. 192, 194. Glassblowing Laboratory. (1, 1)

First and second semesters. One three-hour laboratory period a week. Prerequisite, consent of instructor. (Carruthers.)

For Graduates

The common prerequisites for the following courses are Chem. 187 and 189.

One or more courses of the group, 281-323, will be offered each semester, depending on demand.

Chem. 281. Theory of Solutions. (2)

Two lectures a week. Prerequisite, Chem. 307, or equivalent. (Svirbely.)

Chem. 285. Colloid Chemistry. (2)

Two lectures a week. (Pickard.)

Chem. 287. Infra-red and Raman Spectroscopy. (2)

Two lectures a week. Prerequisites, Chem. 141, 143, 187, 189 and consent of instructor. (Lippincott.)

Chem. 289. Selected Topics in Advanced Colloid Chemistry. (2)

Two lectures a week. Prerequisite, Chem. 285. (Pickard.)

Chem. 295. Heterogeneous Equilibria. (2)

Two lectures a week. (Pickard.)

Chem. 299. Reaction Kinetics. (3)

Three lectures a week. (Svirbely.)

Civil Engineering

Chem. 303. Electrochemistry. (3)

Three lectures a week.

(Pickard.)

Chem. 304. Electrochemistry Laboratory. (2)

Two three-hour laboratory periods a week. Prerequisite, consent of instructor.

(Svirbely.)

Chem. 307. Chemical Thermodynamics. (3)

Three lectures a week.

(Pickard.)

Chem. 311. Physiochemical Calculations. (2)

Two lectures a week.

(Pickard.)

Chem. 313. Molecular Structure. (3)

Three lectures a week.

(Brown.)

Chem. 317. Chemical Crystallography. (3)

Three lectures per week. Prerequisite, consent of instructor.

(Brown.)

Chem. 319, 321. Quantum Chemistry. (3, 2)

Three and two lectures a week. Prerequisite, Chem. 307, or equivalent.

(Lippincott, Mason.)

Chem. 323. Statistical Mechanics and Chemistry. (3)

Three lectures a week. Prerequisite, Chem. 307 or equivalent.

(Brown.)

F. SEMINAR AND RESEARCH

Chem. 351. Seminar. (1)

First and second semesters.

(Staff.)

Chem. 399. Thesis Research.

First and second semesters, summer session.

(Staff.)

CIVIL ENGINEERING

Professors: LOONEY, MAVIS, ALLEN, OTTS AND LEPPER.

Associate Professors: BARBER, COUNRYN AND WEDDING.

The Civil Engineering Department offers graduate work in the following fields: engineering materials, highway engineering, hydraulic engineering, sanitary engineering, soils and foundations, and structural engineering, leading to the degree of Master of Science.

For Graduates and Advanced Undergraduates

C. E. 100. Seminar. (2)

Second semester. Prerequisite, consent of the Department of Civil Engineering.

(Staff.)

C. E. 101. Construction Planning. (3)

Second semester. Prerequisite, consent of the Department of Civil Engineering.

(Staff.)

C. E. 110. Surveying I. (3)

First semester. Two lectures and one laboratory period a week. Prerequisite, consent of instructor. (Gohr and Staff.)

C. E. 111. Surveying II. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisite, C. E. 110, or equivalent. (Gohr and Staff.)

C. E. 112. Photogrammetry. (3)

First or second semester. Two lectures and one laboratory period a week. Prerequisite, C. E. 111, or equivalent. (Gohr.)

C. E. 140. Fluid Mechanics. (3)

First and second semesters. Two lectures and one laboratory period a week. Prerequisite, C. E. 21 and consent of instructor. (Cournyn.)

C. E. 141. Fluid Mechanics. (3)

First and second semesters. Prerequisites, C. E. 20 and consent of instructor. (Cournyn.)

C. E. 142. Hydrology. (3)

First or second semester. Two lectures and one laboratory period a week. Prerequisites, C. E. 140 or C. E. 141. (Cournyn.)

C. E. 150. Soil Mechanics. (3)

First semester. Two lectures and one laboratory period a week. Prerequisites, C. E. 23, 24 and 30, or equivalents. (Barber.)

C. E. 160. Structural Analysis I. (3)

First and second semesters. Two lectures and one laboratory period a week. Prerequisite, C. E. 23, or equivalent. (Piper.)

C. E. 161. Structural Analysis II. (3)

First and second semesters. Prerequisite, C. E. 160, or equivalent. (Piper.)

C. E. 162. Structural Design (Steel). (3)

First semester. Two lectures and one laboratory period a week. Prerequisite, C. E. 160, or equivalent. (Allen, Piper.)

C. E. 163. Structural Design (Concrete). (3)

Second semester. Two lectures and one laboratory period a week. Prerequisites, C. E. 160 and C. E. 161. (Allen, Piper.)

C. E. 170. Water Supply. (3)

First semester. Two lectures and one laboratory period a week. Prerequisite, C. E. 140, or equivalent. (Otts.)

C. E. 171. Sewerage. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisite, C. E. 140, or equivalent. (Otts.)

Civil Engineering

C. E. 180. *Transportation.* (3)

Second semester. Prerequisite, C. E. 110, or equivalent.

(Staff.)

C. E. 181. *Highways.* (3)

Second semester. Two lectures and one laboratory period a week. Prerequisite, C. E. 150, or equivalent.

(Barber.)

For Graduates

C. E. 220. *Advanced Strength of Materials.* (3)

First or second semester. Prerequisite, C. E. 23, or equivalent.

(Wedding.)

C. E. 221. *Experimental Stress Analysis.* (3)

First or second semester. Prerequisite, C. E. 220, or consent of instructor.

(Wedding.)

C. E. 230. *Advanced Properties of Materials.* (3)

First or second semester. Prerequisite, C. E. 30, or equivalent.

(Wedding.)

C. E. 231, 232. *Theory of Concrete Mixtures I, II.* (3, 3)

First and second semesters. Prerequisite, C. E. 30, or equivalent. The second semester of this course is open only to students who are majoring in materials.

(Wedding.)

C. E. 240. *Hydraulic Engineering.* (3)

First or second semester. Prerequisite, C. E. 140 or 141, or equivalent.

(Cournyn.)

C. E. 241. *Hydraulic Machinery.* (3)

First or second semester. Prerequisite, C. E. 140 or 141, or equivalent.

(Cournyn.)

C. E. 250. *Groundwater and Seepage.* (3)

First or second semester. Prerequisite, C. E. 150.

(Barber.)

C. E. 251. *Soil Mechanics.* (3)

First or second semester. Prerequisite, C. E. 150, or equivalent.

(Barber.)

C. E. 252. *Advanced Foundations.* (3)

First or second semester. Prerequisites, C. E. 150, 162 and 163, or equivalents.

(Barber.)

C. E. 253. *Soil Mechanics Laboratory.* (3)

First or second semester. Prerequisite, C. E. 150, or equivalent.

(Barber.)

C. E. 260. *Advanced Structural Analysis I.* (3)

First or second semester. Prerequisite, C. E. 160, or equivalent.

(Piper.)

C. E. 261. *Advanced Structural Analysis II.* (3)

First or second semester. Prerequisite, C. E. 260.

(Staff.)

C. E. 262. *Advanced Structural Design.* (3)

First or second semester. Prerequisites, C. E. 162 and 163, or equivalents.

(Staff.)

C. E. 263. *Structural Design Problems.* (3)

Second semester. Prerequisites, C. E. 260 and 261.

(Staff.)

- C. E. 270. *Advanced Water Supply*. (3)
First or second semester. Prerequisite, C. E. 170, or equivalent. (Ott.)
- C. E. 271. *Advanced Sewerage*. (3)
First or second semester. Prerequisite, C. E. 171 or equivalent. (Staff.)
- C. E. 272. *Sanitary Engineering Design I*. (3)
First or second semester. Prerequisites, C. E. 170 and 171, or equivalents. (Ott.)
- C. E. 273. *Sanitary Engineering Design II*. (3)
First or second semester. Prerequisites, C. E. 170, 171 or equivalent. (Ott.)
- C. E. 274. *Sanitary Engineering Laboratory I*. (3)
First or second semester. Prerequisites, C. E. 170 and 171, or equivalents. (Ott.)
- C. E. 275. *Sanitary Engineering Laboratory II*. (3)
First or second semester. Prerequisites, C. E. 170, 171 or equivalent. (Ott.)
- C. E. 277. *Advanced Sanitation*. (3)
First or second semester. Prerequisite, consent of instructor. (Ott.)
- C. E. 280. *Advanced Highway Engineering I*. (3)
First semester. Prerequisite, C. E. 251, or equivalent. (Staff.)
- C. E. 281. *Advanced Highway Engineering II*. (3)
Second semester. Prerequisite, C. E. 280. (Staff.)
- C. E. 282. *Advanced Highway Engineering Laboratory I*. (1)
First semester. Prerequisite, consent of instructor. (Staff.)
- C. E. 283. *Advanced Highway Engineering Laboratory II*. (1)
Second semester. Prerequisite, consent of instructor. (Staff.)
- C. E. 298. *Seminar*.
First or second semester. Credit in accordance with work outlined by the Department.
Prerequisite, consent of the Department of Civil Engineering. (Staff.)
- C. E. 399. *Research*.
First and second semesters. Credit in accordance with work done. (Staff.)

CLASSICAL LANGUAGES AND LITERATURES

Professor: AVERY.

The Department of Classical Languages and Literatures offers no program leading to the degrees of Master of Arts or Doctor of Philosophy at the present time. The following courses, however, are offered upon sufficient demand to supply the needs of graduate students in other fields, such as English, history, and modern foreign languages, who may wish to do work in Latin in connection with their degree programs in such fields. Students should consult their major professors with respect to application of credit hours in Latin to their graduate programs.

For Graduates and Advanced Undergraduates

Prerequisite, Latin 61 or equivalent.

Latin 101. *Catullus and the Roman Elegiac Poets.* (3)

Lectures and readings on Catullus as a writer of lyric, an imitator of the Alexandrians, and as a writer of elegy, and on Tibullus, Propertius, and Ovid as elegists. The reading of selected poems of the four authors. Reports. (Avery.)

Latin 102. *Tacitus.* (3)

Lectures and readings on Greek and Roman historiography before Tacitus and on the author as a writer of history. The reading of selections from the *Annals* and *Histories*. Reports. (Avery.)

Latin 103. *Roman Satire.* (3)

Lectures and readings on the origins and development of Roman satire. The reading of selections from the satires of Horace, Petronius' *Cena Trimalchionis*, and the satires of Juvenal. Reports. (Avery.)

Latin 104. *Roman Comedy.* (3)

Lectures and readings on the origins and development of Roman comedy. The reading of selected plays of Plautus and Terence. Reports. (Avery.)

Latin 105. *Lucretius.* (3)

Lectures and readings on Greek and Roman Epicureanism. The reading of selections from the *De rerum natura*. Reports. (Avery.)

Latin 111. *Advanced Latin Grammar.* (3)

An intensive study of the morphology and syntax of the Latin language supplemented by rapid reading. (Avery.)

For Graduates

Prerequisite, Latin 61 or equivalent.

Latin 210. *Vulgar Latin Readings.* (3)

An intensive study of the phonology, morphology, and syntax of Classical Latin, followed by the study of the deviations of Vulgar Latin from the classical norms, with the reading of illustrative texts. The reading of selections from the *Perigrinatio ad loca sancta* and the study of divergences from classical usage therein, with special emphasis on those which anticipate subsequent developments in the Romance Languages. Reports. (Avery.)

COMPARATIVE LITERATURE

Professors: ALDRIDGE, FALLS, GOODWYN, HARMAN, MCMANAWAY (P.T.), MURPHY, PRAHL, ZEEVELD AND ZUCKER.

Associate Professors: COOLEY, MANNING, PARSONS AND WEBER.

For Graduates and Advanced Undergraduates

Comp. Lit. 101, 102. Introductory Survey of Comparative Literature. (3, 3)

First semester: Survey of the background of European literature through study of Greek and Latin literature in English translations, discussing the debt of modern literature to the ancients. Second semester: Study of medieval and modern Continental literature. (Zucker.)

Comp. Lit. 103. The Old Testament as Literature. (3)

Second semester. A study of the sources, development and literary types. (Zucker.)

Comp. Lit. 105. Romanticism in France. (3)

First semester. Lectures and readings in the French romantic writers from Rousseau to Baudelaire. Texts are read in English translations. (Parsons.)

Comp. Lit. 106. Romanticism in Germany. (3)

Second semester. Continuation of *Comp. Lit. 105*. German literature from Buerger to Heine in English translations. (Prahl.)

Comp. Lit. 107. The Faust Legend in English and German Literature. (3)

First semester. A study of the Faust legend of the Middle Ages and its later treatment by Marlowe in *Dr. Faustus* and by Goethe in *Faust*. (Prahl.)

Comp. Lit. 112. Ibsen. (3)

First semester. A study of the life and chief works of Henrik Ibsen with special emphasis on his influence on the modern drama. (Zucker.)

Comp. Lit. 114. The Greek Drama. (3)

First semester. The chief works of Aeschylus, Sophocles, Euripides, and Aristophanes in English translations. Emphasis on the historic background, on dramatic structure, and on the effect of the Attic drama upon the mind of the civilized world. (Prahl.)

Comp. Lit. 125. Literature of the Middle Ages. (3)

Narrative, dramatic, and lyric literature of the Middle Ages; studies in translations. (Cooley.)

In addition, the following courses will count as credit in Comparative Literature: Eng. 104, Eng. 113, Eng. 121, Eng. 129, 130, Eng. 144, Eng. 145, Eng. 155, 156, Eng. 157; Spanish 109; Speech 131, 132.

For Graduates

Comp. Lit. 258. Folklore in Literature. (3)

A study of folk heroes, motifs, and ideas as they appear in the world's masterpieces. (Goodwyn.)

Comp. Lit. 301. Seminar in Themes and Types. (3)

Second semester. Intensive study of fundamental motifs and trends in western literature. Prerequisites, one year's work in literature and the knowledge of one language other than English. (Aldridge.)

The following courses will count as credit in Comparative Literature: Eng. 201, Eng. 204, Eng. 206, 207; Eng. 216, 217, Eng. 227, 228, German 203, German 204, German 208.

DAIRY

Professors: ARBUCKLE, DAVIS AND SHAW.

Associate Professors: KEENEY AND MATTICK.

The Dairy Department offers work leading to the degrees of Master of Science and Doctor of Philosophy. Candidates for the Doctor of Philosophy degree have the option of studying in one of two major fields: Dairy Production, which is concerned with breeding, nutrition and physiology of dairy animals, or Dairy Technology, which is concerned with chemical, bacteriological, and nutritional aspects of dairy products, as well as the practical industrial phases of milk processing.

Dairy 102. Physiology of Reproduction. (3)

First semester. Two lectures and one laboratory per week. Anatomy, endocrine physiology, reproductive processes and artificial insemination of cattle. (Staff.)

Dairy 103. Physiology of Milk Secretion. (3)

Second semester. Two lectures and one laboratory period per week. Prerequisites, Zool. 1 and organic chemistry. (Alternate years, given in 1959-60.) The anatomy, evolution and metabolism of the mammary gland including hormonal control and the biosynthesis of milk constituents. (Shaw.)

Dairy 105. Dairy Cattle Breeding. (3)

Second semester, alternate years. Two lectures and one laboratory period a week. Prerequisite, Dairy 1, Zool. 104. A specialized course in breeding dairy cattle. Emphasis is placed on methods of evaluation and selection, systems of breeding, and breeding programs. (Offered 1960-61.) (Davis.)

Dairy 108. Dairy Technology. (4)

First semester. Two lectures and two laboratory periods a week. Prerequisites, Dairy 1, Microb. 133, Chem. 1, 3. Laboratory fee, \$3.00. (Keeney.)

Dairy 109. Market Milk. (4)

First semester. Two lectures and two laboratory periods a week. Prerequisites, Dairy 1, Microb. 133, Chem. 1, 3. Laboratory fee, \$3.00. (Mattick.)

Dairy 110. Concentrated Milk, Cheese and Butter. (4)

First semester. Two lectures and one five-hour laboratory a week. Prerequisites, Dairy 1, Microb. 133 or equivalent; Chem. 1 and 3. Laboratory fee, \$3.00. Methods of production of butter, cheese, condensed and evaporated milk and milk products. Consideration is given to the procedures of processing, quality control and the physiochemical principles involved. (Mattick.)

Dairy 112. Ice Cream Making. (4)

First semester. Two lectures and two laboratory periods a week. Prerequisite, Dairy 108. Laboratory fee, \$3.00. (Arbuckle.)

Dairy 116. Dairy Plant Management. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisites, at

least three advanced dairy products technology courses. Principles of dairy plant management, record systems; personnel, plant design and construction; dairy machinery and equipment. (Mattick.)

Dairy 201. Advanced Ruminant Nutrition. (3)

First semester. Three one-hour lectures per week. Prerequisites, A. H. 110 or Dairy 101, organic chemistry and permission of the Department. (Alternate years). Biochemical, physiological and bacteriological aspects of the nutrition of ruminants and other animals. (Shaw and Davis.)

Dairy 202. Dairy Research Methods. (3)

First semester, alternate years. Prerequisite, permission of the Department. The application of physio-chemical and bio-chemical techniques to dairy research problems including chromatography, spectrophotometry, radioactive isotope tracer techniques and animal balance studies. (Offered 1960-61.)

Dairy 301. Special Problems in Dairying. (1-5) (4 Cr. Max.—M.S., 8 Cr. Max.—Ph.D.)

First and second semesters. Prerequisite, permission of professor in charge of work. Credit in accordance with the amount and character of work done. Methods of conducting dairy research and the presentation of results are stressed. A research problem which relates specifically to the work the student is pursuing will be assigned. (Staff.)

Dairy 302. Advanced Dairy Seminar. (1)

First and second semesters. M.S. candidates can obtain 4 credits; Ph.D. candidates can obtain 6 credits. Assigned readings, presentation and discussion of timely topics and fundamental research in dairy science. (Staff.)

Dairy 399. Research.

First and second semesters. Credit to be determined by the amount and quality of work done. Original investigation by the student of some subject assigned by the major professor, the completion of the assignment and the preparation of a thesis in accordance with requirements for an advanced degree. (Staff.)

ECONOMICS

Professors: DILLARD AND GRUCHY.

Associate Professors: GRAYSON, GURLEY AND HAMBERG.

Assistant Professor: MEASDAY.

MASTER OF ARTS

Requirements for the master's degree include (1) course work in economics as the Department deems appropriate in view of the candidate's previous training, (2) course work in a minor subject, (3) a thesis on a topic approved by the Department, and (4) a comprehensive oral examination covering the major and the minor subjects and defense of the thesis.

DOCTOR OF PHILOSOPHY

The Ph.D. degree in Economics is under the joint direction of the faculties of the Department of Economics and the Department of Business Organization and Administration. Before being advanced to candidacy doctoral students must pass comprehensive written and oral examinations in five of the following fields: (1) Accounting, (2) Comparative Economic Systems and Economic Planning, (3) Economic Development, (4) Economic Theory (required), (5) Financial Administration, (6) History of Economic Thought (required), (7) Industrial Administration, (8) Insurance and Real Estate, (9) International Economics, (10) Labor and Industrial Relations, (11) Marketing, (12) Money and Banking, (13) Public Finance and Fiscal Policy, (14) Public Utilities and Social Control of Business, (15) Transportation, (16) any other field, including the minor, approved by the faculty. Students should consult with members of the faculty concerning the choice of fields and the choice of courses within these fields.

Six semester hours of Statistics with grades of "B" or better must be presented. Normally the foreign language requirements are taken before the comprehensive examinations.

Further information concerning requirements and procedures may be obtained from the Departments administering the program.

For Graduates and Advanced Undergraduates

Econ. 102. National Income Analysis. (3)

First and second semesters. Prerequisite, Econ. 32. An analysis of national income accounts and the level of national income and employment. (Hamberg, Staff.)

Econ. 131. Comparative Economic Systems. (3)

First and second semesters. Prerequisite, Econ. 32 or 37. An investigation of the theory and practice of various types of economic systems. The course begins with an examination and evaluation of the capitalistic system and is followed by an analysis of alternative types of economic systems such as fascism, socialism, and communism. (Gruchy.)

Econ. 132. Advanced Economic Principles. (3)

First and second semesters. Prerequisite, Econ. 32. Required for Economics majors. This course is an analysis of price and distribution theory with special attention to recent developments in the theory of imperfect competition. (Grayson.)

Econ. 134. Contemporary Economic Thought. (3)

First semester. Prerequisites, Econ. 32 and senior standing. A survey of recent trends in American, English, and continental economic thought with special attention to the work of such economists as W. C. Mitchell, J. R. Commons, T. Veblen, W. Sombart, J. A. Hobson and other contributors to the development of economic thought since 1900. (Gruchy.)

Econ. 136. International Economic Policies and Relations. (3)

First semester. Prerequisite, Econ. 32 or 37. A descriptive and theoretical analysis of international trade. Full consideration is given to contemporary problems facing international trade and to the impact of governmental policy upon international commercial relations. (Staff.)

Econ. 137. The Economics of National Planning. (3)

Second semester. Prerequisite, Econ. 32 or 37. An analysis of the principles and practice of economic planning with special reference to the planning problems of Great Britain, Russia, and the United States. (Gruchy.)

Econ. 138. Economics of the Soviet Union. (3)

Second semester. Prerequisite, Econ. 32 or 37. An analysis of the organization, operating principles and performance of the Soviet economy with attention to the historical and ideological background, planning, resources, industry, agriculture, domestic and foreign trade, finance, labor, and the structure and growth of national income. (Dodge.)

Econ. 140. Money and Banking. (3)

First and second semesters. Prerequisite, Econ. 32 or 37. A study of the organization, functions, and operation of our monetary, credit, and banking system; the relation of commercial banking to the Federal Reserve System; the relation of money and credit to prices; domestic and foreign exchange and the impact of public policy upon banking and credit. (Clemens, Glade, Hamberg, Shelby.)

Econ. 141. Theory of Money, Credit, and Prices. (3)

Second semester. Prerequisites, Econ. 32 and 140. A study of recent domestic and international monetary policies, their objectives and theoretical foundations. (Staff.)

Econ. 142. Public Finance and Taxation. (3)

First and second semesters. Prerequisite, Econ. 32 or 37. A study of government fiscal policy with special emphasis upon sources of public revenue, the tax system, government budgets, and the public debt. (Grayson.)

Econ. 147. Business Cycles. (3)

First semester. Prerequisite, Econ. 140. A study of the causes of depressions and unemployment, cyclical and secular instability, theories of business cycles, and the problem of controlling economic instability. (Hamberg.)

Econ. 149. International Finance and Exchange. (3)

Second semester. Prerequisite, Econ. 140; Econ. 136 and 141 recommended. This course considers the theory and practice of international finance and exchange. The increased importance of public authority in foreign trade, international policies, and finance is given due emphasis. (Staff.)

Econ. 160. Labor Economics. (3)

First and second semesters. Prerequisite, Econ. 32 or 37. The historical development and chief characteristics of the American labor movement are first surveyed. Present-day problems are then examined in detail; wage theories, unemployment, social security, labor organization, and collective bargaining. (Dalton, Measday, Smith.)

Econ. 170. Monopoly and Competition. (3)

Second semester. Prerequisite, Econ. 32 or 37. Changing structure of the American economy; price policies in different industrial classifications of monopoly and competition in relation to problems of public policy. (Smith.)

Econ. 171. Economics of American Industries. (3)

Second semester. Prerequisite, Econ. 32 or 37. A study of the technology, economics and geography of twenty representative American industries. (Clemens.)

For Graduates

Econ. 200. Micro-Economic Analysis. (3)

Second semester. Prerequisite, Econ. 132. Price, output, and distribution analysis as developed by Chamberlin, Triffin, Hicks and others; econometric methods including Leontief input-output techniques of inter-industry analysis. Considerable attention is given to contributions in periodicals. (Grayson.)

Econ. 202. Macro-Economic Analysis. (3)

First semester. Prerequisite, Econ. 132. National income accounting; determination of national income and employment especially as related to the modern theory of effective demand; consumption function; multiplier and acceleration principles; the role of money as it affects output and employment as a whole; cyclical fluctuations. (Dillard.)

Econ. 204, 205. Seminar in Economic Development. (3, 3)

First and second semesters. Historical and theoretical analysis of the major factors which influence economic development; comparisons between more developed and less developed areas; policies and techniques which hasten economic development. (Staff.)

Econ. 230. History of Economic Thought. (3)

First semester. Prerequisite, Econ. 132 or consent of instructor. A study of the development of economic thought and theories including the Greeks, Romans, canonists, mercantilists, physiocrats, Adam Smith, Malthus, Ricardo. Relation of ideas to economic policy. (Dillard.)

Econ. 231. Economic Theory in the Nineteenth Century. (3)

Second semester. Prerequisite, Econ. 230 or consent of the instructor. A study of various nineteenth and twentieth century schools of economic thought, particularly the classicists, neo-classicists, Austrians, German historical school, American economic thought and the socialists. (Dillard.)

Econ. 232, 233. Seminar in Institutional Economic Theory. (3, 3)

First and second semesters. A study of recent developments in the field of institutional economic theory in the United States and abroad. (Gruchy.)

Econ. 236. Seminar in International Economic Relations. (3)

(Arranged.) A study of selected problems in International Economic Relations. (Staff.)

Econ. 237. Seminar in Economic Investigation. (3)

(Staff.)

Econ. 240. Seminar in Monetary Theory and Policy. (3)

Theories of money, prices, and national income with emphasis on recent developments. Monetary theories of income fluctuations. Domestic and international monetary policies. (Gurley.)

Econ. 247. Economic Growth and Instability. (3)

Second semester. An analytical study of long-term economic growth in relation to short-term cyclical instability. Attention is concentrated on the connection between accumulation of capital and the capital requirements of secular growth and business cycles. Earlier writings as well as recent growth models are considered. (Hamberg.)

Econ. 270. Seminar in Economics and Geography of American Industries. (3)

(Arranged.)

(Clemens.)

Econ. 399. Thesis.

(Arranged.)

EDUCATION

Professors: ANDERSON, BYRNE, GRENTZER, HOVET, KURTZ, MALEY, MAYOR, MERSHON, MORGAN, NEWELL, PATRICK, PERKINS, PRESCOTT, SCHINDLER, THOMPSON, VAN ZWOLL, WAETJEN AND WIGGIN.

Associate Professors: BLOUGH, BRANDT, HARING, HARRISON, JOHNSON, KEEDY, O'NEILL, RISINGER, SCHNEIDER, TIERNEY AND ULRY.

Assistant Professor: SPENCER.

Master of Arts and Master of Education

A student in Education has the option of qualifying for the degree of Master of Arts or Master of Education.

In addition to the general requirements for admission to the Graduate School, applicants for unconditional admission with a major in Education must have had sixteen semester hours of acceptable undergraduate work in Education and must meet other standards set by this department of the Graduate School.

During the first semester of graduate work, the student is required to take a test battery, at a fee of \$5.00, and to submit professional recommendations. Not later than the completion of the first two courses, the student must select a major advisor and a major area the course requirements for which must be met for favorable consideration for graduation. Following is a list of the major areas:

Adult Education
Business Education
Educational Administration and
Supervision
Elementary School Curriculum
and Instruction

Guidance and Personnel
Higher Education
Music Education
History, Philosophy, and Comparative
Education

Education

Home Economics Education
Secondary School Curriculum and
Instruction

Human Growth and Development
Industrial Arts Education
Vocational Industrial Education

The time limit for completing either degree is the same as that prescribed for the Master of Arts and the Master of Science degrees of the Graduate School.

Master of Arts Requirements

No student is recommended to the Graduate Council for advancement to candidacy for the Master of Arts degree until he has successfully passed the qualifying examination and has completed at least twelve hours of satisfactory graduate work at the University of Maryland. The candidate must meet all requirements including thesis and successful passing of the oral examination as prescribed by the Graduate School for the Master of Arts degree.

Master of Education Requirements

A student may be recommended for advancement to candidacy on the basis of course work plus recommendations of his major advisor and the Education Master's Committee acting for the Department of Education. The Master of Education candidate will write two seminar papers and will take a final comprehensive examination covering all course work. The final examination must be taken by the full-time student in the second semester of course work and by the part-time student during the time he is enrolled for the last six hours of course work.

Currently both the qualifying and the comprehensive examinations are administered on the second Saturday of January and May and on the Saturday of the fourth week of the summer session.

For further information respecting the master's degrees in Education, see the statement of policy issued by the Department of Education.

Doctor of Philosophy and Doctor of Education

Each candidate is required to achieve exceptional ability in at least one major area and one minor area of competence.

The candidate should choose his major from the following list of areas:

Curriculum and Instruction
Educational Administration
and Supervision

Elementary Education

Guidance and Personnel

*Physical Education, Recreation,
and Health

History, Philosophy, and Comparative
Education

Human Development Education

Industrial Arts Education

Secondary Education

Vocational-Industrial Education

*The Ph.D. Program in this area is administered under a separate department of the Graduate School.

Minors may be chosen from fields other than Education as approved by the Committee on Candidacy, from the foregoing list of major areas, or from the following list:

Adult Education	Higher Education
**Agricultural Education	Home Economics Education
Business Education	Music Education

In addition to the general University requirements for a doctor's degree, the following requirements must be met:

1. The preliminary examination for admission to candidacy for the doctor's degree will cover the student's preparation in major and minor fields, and will include such other examinations as may be required by the faculty. A student must be admitted to candidacy in order to have the Department's official permission to be a candidate for a doctor's degree.

2. A comprehensive examination covering the general fields of major and minor study must be passed by each candidate, after which the final examination is administered by a committee appointed by the Dean of the Graduate School.

In general the requirements for the Doctor of Education degree are the same as those for the degree Doctor of Philosophy. The most important differences between the two degrees are as follows:

1. The purpose of the Doctor of Education degree is to prepare persons of exceptional competence to work in the field. The emphasis for this degree is placed on broad understanding, whereas that for the degree of Doctor of Philosophy is placed on specialized research.

2. A reading knowledge of foreign languages is required for the degree of Doctor of Education only when needed for research and study in the doctoral program.

3. In order to meet the residence requirements, a candidate for the Ph.D. degree must spend at least two semesters in full-time study on the College Park campus. A candidate for the Ed.D. degree may substitute two summers of residence for one semester of residence, or four summers for two semesters.

4. The doctoral study for the Ed.D. consists of a project rather than a dissertation. The project requires research to meet a practical field problem. Credit of six to nine hours is allowed for a project as compared with twelve to eighteen hours for a Ph.D. dissertation. For further information respecting the doctor's degree, see the "Statement of Policy, Doctoral Degrees in Education" issued by the Department of Education.

**Administered under a separate department of the Graduate School.

A. HISTORY, PRINCIPLES, CURRICULUM, AND ADMINISTRATION

For Graduates and Advanced Undergraduates

Ed. 100. History of Education in Western Civilization. (3)

Educational institutions through the ancient, mediaeval, and early modern periods in the western civilization, as seen against a background of socio-economic development. (Wiggin.)

Ed. 102. History of Education in the United States. (3)

A study of the origins and development of the chief features of the present system of education in the United States. (Wiggin.)

Ed. 107. Philosophy of Education. (2-3)

A study of the great educational philosophers and systems of thought affecting the development of modern education. (Wiggin.)

Ed. 121. The Language Arts in the Elementary School. (2)

Teaching of spelling, handwriting, oral and written expression, and creative expression. Special emphasis given to skills having real significance to pupils. (Staff.)

Ed. 122. The Social Studies in the Elementary School. (2)

Consideration given to curriculum, organization and methods of teaching, evaluation of newer materials, and utilization of environmental resources. (O'Neill.)

Ed. 123. The Child and the Curriculum. (3)

Relationship of the elementary school curriculum to child growth and development. Recent trends in curriculum organization; the effect of environment on learning; readiness to learn; and adapting curriculum content and methods to maturity levels of children. (Denecke.)

Ed. 124. Arithmetic in the Elementary School. (2)

Emphasis on materials and procedures which help pupils sense arithmetical meanings and relationships. Helps teachers gain a better understanding of the number system and arithmetical processes. (Schindler.)

Ed. 125. Art in Elementary Schools. (2)

Concerned with art methods and materials for elementary schools. Includes laboratory experiences with materials appropriate for elementary schools. (Lembach.)

Ed. 127. Teaching in Elementary Schools. (2-6)

An overview of elementary school teaching designed for individuals without specific preparation for elementary school teaching or for individuals without recent teaching experience. (Staff.)

Ed. 130. The Junior High School. (2-3)

A general overview of the junior high school. Purposes, functions and characteristics of this school unit; a study of its population, organization, program of studies, methods, staff, and other similar topics, together with their implications for prospective teachers. (Staff.)

Ed. 133. Methods of Teaching Social Studies in Secondary School. (2-3)

Designed to give practical training in the everyday teaching situations. Use of various lesson techniques, audio and visual aids, reference materials, and testing programs and the adaption of teaching methods to individual and group differences. Present tendencies and aims of instruction in the social studies. (Risinger.)

Ed. 134. Materials and Procedures for the Secondary School Core Curriculum. (3)

This course is designed to bring practical suggestions to teachers who are in charge of core classes in junior and senior high schools. Materials and teaching procedures for specific units of work are stressed. Laboratory fee, \$1.00. (Schneider.)

Ed. 137. Methods of Teaching Mathematics and Science in Secondary School. (2-3)

Considers such topics as objectives, selection, organization, and presentation of subject matter, appropriate classroom methods and procedures, instructional materials and evaluation of learning experiences in the areas of mathematics, the physical sciences, and the biological sciences. Laboratory fee, \$2.00. (Ulry, Mayor, Keedy.)

Ed. 140. Curriculum, Instruction, and Observation. (3)

(Graduate credit is allowed only by special permission.)

First and/or second semesters. Offered in separate sections for the various subject matter areas, namely, English, social studies, foreign language, science, mathematics, art education, business education, industrial education, music education, and physical education. Registration cards must include the subject-matter area as well as the name and number of the course. The objectives, selection and organization of subject matter, appropriate methods, lesson plans, textbooks, and other instructional materials, measurement, and other topics pertinent to the particular subject matter area are treated. Twenty periods of observation. (Staff.)

Ed. 141. Methods of Teaching English in Secondary Schools. (3)

Content and methods in teaching the English language arts. (Bryan.)

Ed. 145. Principles and Methods of Secondary Education. (2-3)

First and second semesters and summer session. This course is concerned with the principles and methods of teaching in junior and senior high schools. Instructional problems common to all of the subject fields are considered in relation to the needs and interests of youth, the urgent social problems of today, and the central values to which our society is committed. (Staff.)

Ed. 147. Audio-Visual Education. (3)

First semester and summer session. Laboratory fee, \$1.00. Sensory impressions in their relation to learning; projection apparatus, its cost and operation; slides, film-strips, and films; physical principles underlying projection; auditory aids to instruction; field trips; pictures, models, and graphic materials; integration of sensory aids with organized instruction. Recommended for all education students. (Maley.)

Ed. 150. Educational Measurement. (2)

First and second semesters and summer session. Constructing and interpreting measures of achievement. (Johnson.)

Ed. 153. The Teaching of Reading. (2)

Concerned with the fundamentals of developmental reading instruction, including reading readiness, use of experience records, procedures in using basal readers, the improvement of comprehension, teaching reading in all areas of the curriculum, uses of children's literature, the program in word analysis, and procedures for determining individual needs. (Matson, Schindler.)

Ed. 154. Remedial Reading Instruction. (2)

Prerequisite, Ed. 153 or the equivalent. For supervisors and teachers who wish to help retarded readers. Concerned with causes of reading difficulties, the identification and diagnosis of retarded pupils, instructional materials, and teaching procedures. (Schindler.)

Ed. 155. Laboratory Practices in Reading for Elementary and Secondary Schools. (2-4)

Prerequisite, Ed. 153 or Ed. 154. A laboratory course in which each student has one or more pupils for analysis and instruction. At least one class meeting per week to diagnose individual cases and to plan instruction. (Schindler.)

Ed. 160. Educational Sociology. (2)

Deals with data of the social sciences which are germane to the work of teachers. Implications of democratic ideology for educational endeavor, educational tasks imposed by changes in population and technological trends, the welfare status of pupils, the socio-economic attitudes of individuals who control the schools, and other elements of community background. (Risinger.)

Ed. 161. Principles of Guidance. (3)

First and second semesters and summer session. Overview of principles and practices of guidance-oriented education. (Byrne.)

Ed. 162. Mental Hygiene in the Classroom. (2)

The practical application of the principles of mental hygiene to classroom problems. (Denecke.)

Ed. 163, 164, and 165. Community Study Laboratory I, II and III. (2, 2, 2)

Involves experience from the educational standpoint with the agencies, institutions, cultural patterns, living conditions, and social processes which play significant roles in shaping the behavior of children and adults and which must be understood by individuals working toward school and community improvement. Each participant becomes a member of a group in a given area of study and concentrates on problems which have direct application in his school situation. Readings are integrated with techniques of study. (Schindler.)

Ed. 187. Field Experience in Education. (1-4)

- | | |
|-------------------------------|------------------------------------|
| a. Adult Education | e. Higher Education |
| b. Curriculum and Instruction | f. Industrial Arts Education |
| c. Educational Administration | g. Supervision |
| d. Guidance and Personnel | h. Vocational-Industrial Education |

Planned field experience may be provided for selected graduate students who have had teaching experience and whose application for such field experience has been ap-

proved by the Education faculty. Field experience is offered in a given area to both major and non-major students. Prerequisites, at least six semester hours in Education at the University of Maryland plus such other prerequisites as may be set by the major area in which the experience is to be taken. (Staff.)

Ed. 188. Special Problems in Education. (1-3)

Prerequisite, consent of instructor. Available only to mature students who have definite plans for individual study of approved problems. (Staff.)

Note: Course cards must have the title of the problem and the name of the faculty member who has approved it.

Ed. 189. Workshops, Clinics, and Institutes. (1-6)

The following types of educational enterprises may be scheduled under this course heading: workshops conducted by the College of Education (or developed cooperatively with other colleges and universities) and not otherwise covered in the present course listing; clinical experiences in pupil-testing centers, reading clinics, speech therapy laboratories, and special education centers; institutes developed around specific topics or problems and intended for designated groups such as school superintendents, principals, and supervisors. The maximum number of credits that may be earned under this course symbol toward any degree is six semester hours; the symbol may be used two or more times until six semester hours have been reached. (Staff.)

Ed. 190. Problems and Trends in Contemporary American Education. (2-4)

Designed to present a broad overview of some key issues and trends that relate to the improvement of instruction at elementary, secondary and teacher education levels. Lectures by visiting educators of national prominence will be reviewed and analyzed in discussion groups led by regular University staff members.

For Graduates

Ed. 202. The Junior College. (2)

The philosophy and development of the junior college in the United States with emphasis on curriculum and administrative controls. (Staff.)

Ed. 203. Problems in Higher Education. (3)

A study of present problems in higher education. (Wiggin.)

Ed. 205. Comparative Education. (3)

A study of historical changes in ways of looking at national school systems, and of problems in assessing their effectiveness. (Wiggin.)

Ed. 206. Seminar in Comparative Education. (2)

(Wiggin.)

Ed. 207. Seminar in History and Philosophy of Education. (2)

(Wiggin.)

Ed. 209. Adult Education. (3)

A study of adult education in the United States, with attention to adult abilities and intelligence, programs of adult education, and a rationale for adult education.

(Wiggin.)

Education

Ed. 210. The Organization and Administration of Public Education. (3)

First semester. The basic course in school administration. Deals with the organization and administration of school systems—at the local, state, and federal levels; and with the administrative relationships involved. (Newell.)

Ed. 211. The Organization, Administration, and Supervision of Secondary Schools. (2)

Second semester. The work of the secondary school principal. Includes topics such as personnel problems, supervision, school-community relationships, student activities, schedule making, and internal financial accounting. (Schneider.)

Ed. 212. School Finance and Business Administration. (3)

An introduction to principles and practices in the administration of the public school finance activity. Sources of tax revenue, the budget, and the function of finance in the educational program are considered. (Van Zwoll.)

Ed. 214. School Plant Planning. (2)

An orientation course in which the planning of school buildings is developed as educational designing with reference to problems of site, building facilities, and equipment. (Van Zwoll.)

Ed. 216. High School Supervision. (2)

Prerequisite, teaching experience. Deals with recent trends in supervision; the nature and function of supervision; planning supervisory programs; evaluation and rating; participation of teachers and other groups in policy development; school workshops; and other means for the improvement of instruction. (Schneider.)

Ed. 217. Administration and Supervision in Elementary Schools. (2)

Problems in administering elementary schools and improving instruction. (Denecke.)

Ed. 218. School Surveys. (2-6)

Prerequisite, consent of instructor. Includes study of school surveys with emphasis on problems of school organization and administration, finance and school plant planning. Field work in school surveys is required. (Newell.)

Ed. 219. Seminar in Educational Administration and Supervision. (2-4)

Prerequisite, at least four hours in educational administration and supervision or consent of instructor. A student may register for two hours and may take the seminar a second time for an additional two hours. (Newell, Van Zwoll.)

Ed. 220. Pupil Transportation. (2)

Includes consideration of the organization and administration of state, county, and district pupil transportation service with emphasis on safety and economy. The planning of bus routes; the selection and training of bus drivers, and maintenance mechanics; the specification of school buses; and procurement procedures are included. (Staff.)

Ed. 221. Advanced School Plant Planning. (2)

This is an advanced course in school plant planning problems. Emphasis is given to analysis of the educational program and planning of physical facilities to accommodate that program. Ed. 214 is a prerequisite to this course. However, students with necessary background may be admitted without completion of Ed. 214. (Van Zwoll.)

Ed. 223. Practicum in Personnel Relationships. (2-6)

Prerequisite, consent of instructor. Enrollment limited. Designed to help teachers, school administrators, and other school staff members to learn to function more effectively in developing educational policy in group situations. Each student in the course is required to be working concurrently in the field with a group of school staff members or citizens on actual school problems. (Newell.)

Ed. 224. Apprenticeship in Education. (6-9)

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|-------------------------------|------------------------------------|
| a. Curriculum and Instruction | e. Industrial Arts Education |
| b. Educational Administration | f. Supervision |
| c. Guidance and Personnel | g. Vocational Industrial Education |
| d. Higher Education | |

Apprenticeships in the major area of study are available to selected students whose application for an apprenticeship has been approved by the Education faculty. Each apprentice is assigned to work for at least a semester full-time or the equivalent with an appropriate staff member of a cooperating school, school system, or educational institution or agency. The sponsor of the apprentice maintains a close working relationship with the apprentice and the other persons involved. Prerequisites, teaching experience, a master's degree in Education, and at least six semester hours in Education at the University of Maryland. (Staff.)

Note: The total number of credits which a student may earn in Ed. 187, Ed. 224, and Ed. 287 is limited to a maximum of twenty (20) semester hours.

Ed. 225. School Public Relations. (3)

A study of the interrelationships between the community and the school. Public opinion, propaganda, and the ways in which various specified agents and agencies within the school have a part in the school public relations program are explored. (Van Zwoll.)

Ed. 226. Child Accounting. (2)

An inquiry into the record keeping activities of the school system, including an examination of the marking system. (Van Zwoll.)

Ed. 227. Public School Personnel Administration. (3)

A comparison of practices with principles governing the satisfaction of school personnel needs, including a study of tenure, salary schedules, supervision, rewards, and other benefits. (Van Zwoll.)

Ed. 228. Seminar in Student Personnel. (2)

Prerequisite, consent of instructor. (Same as Psych. 228.) A systematic analysis of research and theoretical literature on a variety of major problems in the organization and administration of student personnel services in higher education. Included will be discussion of such topics as the student personnel philosophy in education, counseling services, discipline, housing, student activities, financial aid, health, remedial services, etc. (Byrne.)

Ed. 229. Seminar in Elementary Education. (2)

Primarily for individuals who wish to write seminar papers. Enrollment should be preceded by at least 12 hours of graduate work in Education. (Staff.)

Ed. 230. Elementary School Supervision. (2)

Concerned with the nature and function of supervision, various supervisory techniques and procedures, human relationship factors and personal qualities for effective supervision. (Denecke.)

Ed. 234. The School Curriculum. (2-3)

A foundations course embracing the curriculum as a whole from early childhood through adolescence, including a review of historical developments, an analysis of conditions affecting curriculum change, an examination of issues in curriculum making, and a consideration of current trends in curriculum design. (Hovet.)

Ed. 235. Principles of Curriculum Development. (3)

Curriculum planning, improvement, and evaluation in the schools; principles for the selection and organization of the content and learning experiences; ways of working in classroom and school on curriculum improvement. (Hovet, Anderson.)

Ed. 237. Curriculum Theory and Research. (2)

The school curriculum considered within the totality of factors affecting pupil behavior patterns, an analysis of research contributing to the development of curriculum theory, a study of curriculum theory as basic to improved curriculum design, the function of theory in guiding research, and the construction of theory through the utilization of concepts from the behavior research disciplines. (Hovet.)

Ed. 239. Seminar in Secondary Education. (2)

(Staff.)

Ed. 242. Coordination in Work-Experience Programs. (2)

Surveys and evaluates the qualifications and duties of a teacher-coordinator in a work-experience program. Deals particularly with evolving patterns in city and county schools in Maryland, and is designed to help teacher-coordinators, guidance counselors, and others in the supervisory and administrative personnel concerned with functioning relationships of part-time cooperative education in a comprehensive educational program.

Ed. 243. Problems of Teaching Arithmetic in Elementary Schools. (2)

Implications of theory and results of research for the teaching of arithmetic in the elementary schools. (Schindler.)

Ed. 244. Problems of Teaching Language Arts in Elementary Schools. (2)

Implications of current theory and results of research for the language arts in the elementary schools. (Staff.)

Ed. 245. Introduction to Research. (2)

Intensive reading, analysis, and interpretation of research; applications to teaching fields; the writing of abstracts, research reports, and seminar papers. (Hovet.)

Ed. 246. Problems of Teaching Social Studies in Elementary Schools. (2)

Application to the social studies program of selected theory and research in the social sciences, emphasizing patterns of behavior, environmental influences, and critical thinking. (O'Neill.)

Ed. 247. Seminar in Science Education. (2)

An opportunity to pursue special problems in curriculum making, course of study development, or other science teaching problems. Class members may work on problems related directly to their own school situations. (Blough, Ulry.)

Ed. 248. Seminar in Industrial Arts and Vocational Education. (2)

(See Ind. Ed. 248)

(Maley.)

Ed. 250. Analysis of the Individual. (3)

Knowing students through use of numerous techniques. Ed. 161 desirable as prerequisite. (Byrne.)

Ed. 253. Guidance Information. (2)

Finding, filing, and using information needed by students for making choices, plans, and adaptations in school, occupations, and in inter-personal relations. Ed. 161 desirable as prerequisite. (Byrne.)

Ed. 254. Organization and Administration of Guidance Programs. (2)

Instilling the guidance point of view and implementing guidance practices. All guidance courses except Seminar are prerequisites. (Byrne.)

Ed. 260. School Counseling: Theoretical Foundations and Practice. (3)

Prerequisites, Ed. 161, 250, 253. Prerequisites may be waived by instructor. Exploration of learning theories as applied to counseling in schools, and practices which stem from such theories. (Byrne.)

Ed. 261. Practicum in School Counseling. (2)

Prerequisite, Ed. 260. Limited to 15 applicants in advance, who will have one or more pupils available for counseling. (Byrne.)

Ed. 263, 264. Aptitudes and Aptitude Testing. (2, 2)

(Offered in Baltimore.)

Ed. 267. Curriculum Construction Through Community Analysis. (2)

Prerequisites, Ed. 163, 164, 165. Selected research problems in the field of community study with emphasis on Baltimore area. (Staff.)

Ed. 268. Seminar in Educational Sociology. (2)

(Staff.)

Ed. 269. Seminar in Guidance. (2)

Registration only by approval of instructor. Final guidance course. Students study research and conduct one. (Byrne.)

Ed. 279. Seminar in Adult Education. (2)

(Wiggin.)

Ed. 280. Research Methods and Materials. (2)

Research methodology for case studies, surveys, and experiments; measurement and statistical techniques; design, form, and style for theses and research reports. Primarily for advanced students and doctoral candidates. (Johnson.)

Ed. 281. Source Materials in Education. (2)

Bibliography development through a study of source materials in education, special fields in education, and for seminar papers and theses. (Denecke.)

Ed. 287. Internship in Education. (12-16)

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|-------------------------------|------------------------------------|
| a. Curriculum and Instruction | d. Industrial Arts Education |
| b. Educational Administration | e. Supervision |
| c. Guidance and Personnel | f. Vocational-Industrial Education |

Internships in the major area of study are available to selected students who have teaching experience. The following groups of students are eligible: (a) any student who has been advanced to candidacy for the doctor's degree; and (b) any student who receives special approval by the Education faculty for an internship, provided that prior to taking an internship, such student shall have completed at least sixty semester hours of graduate work, including at least six semester hours in Education at the University of Maryland. Each intern is assigned to work on a full-time basis for at least a semester with an appropriate staff member in a cooperating school, school system, or educational institution or agency. The internship must be taken in a school situation different from the one where the student is regularly employed. The intern's sponsor maintains a close working relationship with the intern and the other persons involved.

Note: The total number of credits which a student may earn in Ed. 187, Ed. 224, and Ed. 287 is limited to a maximum of twenty (20) semester hours.

Ed. 288. Special Problems in Education. (1-6)

First and second semesters and summer session. Master of Education or doctoral candidates who desire to pursue special research problems under the direction of their advisors may register for credit under this number. (Staff.)

Note: Course card must have the title of the problem and the name of the faculty member under whom the work will be done.

Ed. 290. Doctoral Seminar. (1-3)

Prerequisite, passing the preliminary examinations for a doctor's degree in Education, or recommendation of a doctoral advisor. Analysis of doctoral projects and theses, and of other on-going research projects. A doctoral candidate may participate in the Seminar during as many University sessions as he desires, but may earn no more than three semester hours of credit in the Seminar. An Ed.D. candidate may earn in total no more than nine semester hours, and a Ph.D. candidate, no more than eighteen semester hours, in the Seminar and in Ed. 399. (Staff.)

Ed. 399. Research-Thesis. (1-6)

First and second semesters and summer session. Students who desire credit for a master's thesis, a doctoral dissertation, or a doctoral project should use this number. (Staff.)

B. BUSINESS EDUCATION

For Graduates and Advanced Undergraduates

B. Ed. 101. Problems in Teaching Office Skills. (2)

Problems in development of occupational competency, achievement tests, standards of achievement, instructional materials, transcription, and the integration of office skills. (Patrick.)

B. Ed. 102. *Methods and Materials in Teaching Bookkeeping and Related Subjects.* (2)

Important problems and procedures in the mastery of bookkeeping and related office knowledges and skills including a consideration of materials and teaching procedures. (Patrick.)

B. Ed. 104. *Basic Business Education in the Secondary Schools.* (2)

Includes consideration of course objectives; subject matter selection; and methods of organizing and presenting business principles, knowledges, and practices. (Patrick.)

For Graduates

B. Ed. 200. *Administration and Supervision of Business Education.* (2)

Major emphasis on departmental organization, curriculum, equipment, budget making, guidance, placement and follow-up, visual aids and the in-service training of teachers. For administrators, supervisors, and teachers of business subjects. (Staff.)

B. Ed. 255. *Principles and Problems of Business Education.* (2)

Principles and practices in business education; growth and present status; vocational business education; general business education; relation to consumer education and to education in general. (Patrick.)

B. Ed. 256. *Curriculum Development in Business Education.* (2-6)

This course is especially designed for graduate students interested in devoting the summer session to a concentrated study of curriculum planning in business education. Emphasis will be placed on the philosophy and objectives of the business education program, and on curriculum research and organization of appropriate course content. (Staff.)

C. CHILDHOOD EDUCATION

For Graduates and Advanced Undergraduates

C. Ed. 110. *Child Development III.* (3)

First and second semesters. Developmental growth of the child from the prenatal period through the early childhood years, with implications for home and school practice. For students in other colleges of the University.

C. Ed. 115. *Children's Activities and Activities Materials.* (3)

First and second semesters. Prerequisites, C. Ed. 100, 101, or 110. Laboratory fee, \$5.00. Storytelling; selection of books for pre-school children; the use, preparation, and presentation of such raw materials as clay, paint (easel and finger), blocks, wood, and scrap materials for nursery school and kindergarten.

C. Ed. 116. *Creative Music for Young Children.* (2-3)

Prerequisite, Mus. 16 or equivalent. First and second semesters. Creative experiences in songs and rhythms; correlation of music and everyday teaching with the abilities and development of each level; study of songs and materials; observation and teaching experience with each age level. (Brown.)

C. Ed. 119. *Curriculum, Instruction, and Observation—Cooperative Nursery School.* (2-3)

Education

C. Ed. 140. Curriculum, Instruction, and Observation—Early Childhood Education (Nursery School and Kindergarten). (3)

Prerequisites, C. Ed. 100, 101, or 110. Philosophy of early childhood education; observation of the developmental needs at various age levels, with emphasis upon the activities, materials, and methods by which educational objectives are attained.
(Stant and Glass.)

C. Ed. 145. Guidance in Behavior Problems. (3)

First and second semesters. Development of an appreciation and understanding of young children from different home and community backgrounds; study of individual and group problems.
(Glass.)

C. Ed. 160. Methods and Materials in Parent Education. (2-3)

A survey of child development, child guidance, and related fields; a review of current materials, books, periodicals, leaflets, films, skits; study of individual parent conferences, guided observation, discussion leading, role playing, preparing materials and programs for parent groups and television skits with laboratory practice through the group itself.
(Staff.)

D. HOME ECONOMICS EDUCATION

For Graduates and Advanced Undergraduates

H. E. Ed. 102. Problems in Teaching Home Economics. (3)

First and second semesters. Prerequisite, H. E. Ed. 140. A study of the managerial aspects of teaching and administering a home-making program; the physical environment, organization, and sequence of instructional units, resource materials, evaluation, home projects.
(Spencer.)

H. E. Ed. 120. Evaluation of Home Economics. (3)

The meaning and function of evaluation in education; the development of a plan for evaluating a homemaking program with emphasis upon types of evaluation devices, their construction, and use.
(Spencer.)

H. E. Ed. 140. Curriculum, Instruction, and Observation. (3)

The place and function of home economics education in the secondary school curriculum. Philosophy of education for home and family living; characteristics of adolescence, construction of source units, lesson plans, and evaluation devices; directed observation in junior and senior high school home economics departments.
(Spencer.)

For Graduates

H. E. Ed. 200. Seminar in Home Economics Education. (2)

(Spencer.)

H. E. Ed. 202. Trends in the Teaching and Supervision of Home Economics. (2-4)

Study of home economics programs and practices in light of current educational trends. Interpretation and analysis of democratic teaching procedures, outcomes of instruction, and supervisory practices.
(Spencer.)

E. HUMAN DEVELOPMENT EDUCATION

For Graduates and Advanced Undergraduates

H. D. Ed. 100, 101. *Principles of Human Development I and II.* (3, 3)

These courses give a general overview of the scientific principles that describe human development and behavior and relate these principles to the task of the school. A year-long study of an individual child is an integral part of the course and will require one half-day per week for observing children in nearby schools. *This course is designed to meet the usual certification requirements in Educational Psychology.* H. D. Ed. 100 is prerequisite to H. D. Ed. 101. (Staff.)

H. D. Ed. 102, 103, 104. *Child Development Laboratory I, II and III.* (2, 2, 2)

These courses involve the direct study of children throughout the school year. Each participant gathers a wide body of information about an individual, presents the accumulating data from time to time to the study group for criticism and group analysis and writes an interpretation of the dynamics underlying the child's learning, behavior and development. Provides opportunity for teachers in-service to earn credit for participation in their own local child study group. (Staff.)

H. D. Ed. 112, 114, 116. *Scientific Concepts in Human Development I, II, III.* (3, 3, 3)

Summer session.

(Staff.)

H. D. Ed. 113, 115, 117. *Laboratory in Behavior Analysis I, II, III.* (3, 3, 3)

Summer session.

(Staff.)

For Graduates

H. D. Ed. 200. *Introduction to Human Development and Child Study.* (3)

Offers a general overview of the scientific principles which describe human development and behavior and makes use of these principles in the study of individual children. Each student will observe and record the behavior of an individual child throughout the semester and must have one half-day a week for this purpose. It is basic to further work in child study and serves as a prerequisite for advanced courses where the student has not had field work or at least six weeks of workshop experience in child study. When offered during the summer intensive laboratory work with case records may be substituted for the study of an individual child. (Staff.)

H. D. Ed. 201. *Biological Bases of Behavior.* (3)

Emphasizes that understanding human life, growth and behavior depends on understanding the ways in which the body is able to capture, control and expend energy. Application throughout is made to human body processes and implications for understanding and working with people. H. D. Ed. 250 a or b or c must be taken concurrently with this course. H. D. Ed. 200 or its equivalent must be taken before H. D. Ed. 201 or concurrently. (Staff.)

H. D. Ed. 202. *Social Bases of Behavior.* (3)

Analyzes the socially inherited and transmitted patterns of pressures, expectations and limitations learned by an individual as he grows up. These are considered in rela-

tion to the patterns of feeling and behaving which emerge as the result of growing up in one's social group. H. D. Ed. 250 a or b or c must be taken concurrently with this course. H. D. Ed. 200 or its equivalent must be taken before H. D. Ed. 202 or concurrently. (Staff.)

H. D. Ed. 203. Integrative Bases of Behavior. (3)

Analyzes the organized and integrated patterns of feeling, thinking and behaving which emerge from the interaction of basic biological drives and potentials with one's unique experience growing up in a social group. H. D. Ed. 250 a or b or c must be taken concurrently with this course. H. D. Ed. 200 or its equivalent, H. D. Ed. 201 and H. D. Ed. 202 are prerequisite. (Staff.)

H. D. Ed. 204, 205. Physical Processes in Human Development. (3, 3)

Describes in some detail the major organic processes of: conception, biological inheritance; differentiation and growth of the body; capture, transportation and use of energy; perception of the environment; coordination and integration of function; adaptation to unusual demands and to frustration; normal individual variation in each of the above processes. H. D. Ed. 250 a or b or c must be taken concurrently with this course. (Staff.)

H. D. Ed. 206, 207. Socialization Processes in Human Development I, II. (3, 3)

Analyzes the processes by which human beings internalize the culture of the society in which they live. The major sub-cultures in the United States, their training procedures, and their characteristic human expressions in folk-knowledge, habits, attitudes, values, life-goals, and adjustment patterns are analyzed. Other cultures are examined to highlight the American way of life and to reveal its strengths and weaknesses. H. D. Ed. 250 a or b or c must be taken concurrently with this course. (Staff.)

H. D. Ed. 208, 209. Self Processes in Human Development I and II. (3, 3)

Analyzes the effects of the various physical and growth processes, affectional relationships, socialization processes, and peer group roles and status on the integration, development, adjustment, and realization of the individual self. This analysis includes consideration of the nature of intelligence and of the learning process; the development of skills, concepts, generalizations, symbolizations, reasoning and imagination, attitudes, values, goals and purposes; and the conditions, relationships and experiences that are essential to full human development. The more common adjustment problems experienced in our society at various maturity levels, and the adjustment mechanisms used to meet them are studied. H. D. Ed. 250 a or b or c must be taken concurrently with this course. (Staff.)

H. D. Ed. 210. Affectional Relationships and Processes in Human Development. (3)

Describes the normal development, expression and influence of love in infancy, childhood, adolescence and adulthood. It deals with the influence of parent-child relationship involving normal acceptance, neglect, rejection, inconsistency, and over-protection upon health, learning, emotional behavior and personality adjustment and development. H. D. Ed. 250 a or b or c must be taken concurrently with this course. H. D. Ed. 200 or its equivalent must be taken before or concurrently. (Staff.)

H. D. Ed. 211. Peer-culture and Group Processes in Human Development. (3)
 Analyzes the processes of group formation, role-taking and status-winning. It describes the emergence of the "peer-culture" during childhood and the evolution of the child society at different maturity levels to adulthood. It analyzes the developmental tasks and adjustment problems associated with winning belonging and playing roles in the peer group. H. D. Ed. 250 a or b or c must be taken concurrently with this course. H. D. Ed. 200 or its equivalent must be taken before or concurrently. (Staff.)

H. D. Ed. 212, 214, 216. Advanced Scientific Concepts in Human Development I, II, III. (3, 3, 3)

Summer session. (Staff.)

H. D. Ed. 213, 215, 217. Advanced Laboratory in Behavior Analysis I, II, III. (3, 3, 3)

Summer session. (Staff.)

H. D. Ed. 218. Workshop in Human Development. (6)

Summer session. Prerequisites, H. D. Ed. 212, 213, 214, 215, 216, 217. (Staff.)

H. D. Ed. 219. Psycho-Social Development of Exceptional Children. (3)

Summer session. Studies intensively the psychology of exceptional children with stress upon the interrelationship among the psychological, physical, and social development of these children. (Staff.)

H. D. Ed. 220. Developmental Tasks. (3)

Describes the series of developmental tasks faced by children. These tasks, made necessary by the normal processes of growth and development, are learnings that the child needs and desires to accomplish because of emerging capacities for action and relationship, because of the demands and expectancies of his family and of society, and because of the progressive clarification and the directive powers of his own interests, attitudes, values and aspirations. Emphasis will be placed on the use of developmental tasks concepts in educational planning and practice. H. D. Ed. 200 or its equivalent, H. D. Ed. 201, and H. D. Ed. 202 are prerequisite. (Staff.)

H. D. Ed. 230, 231. Field Program in Child Study I and II. (2-6)

Prerequisite, consent of instructor. Offers apprenticeship training preparing properly qualified persons to become staff members in human development workshops, consultants to child study field programs and coordinators of municipal or regional child study programs for teachers or parents. Extensive field experience is provided. In general this training is open only to persons who have passed their preliminary examinations for the doctorate with a major in human development or psychology. (Staff.)

H. D. Ed. 250a, 250b, 250c. Direct Study of Children. (1, 1, 1)

Provides the opportunity to observe and record the behavior of an individual child in a nearby school. These records will be used in conjunction with the advanced courses in human development and this course will be taken concurrently with such courses. Teachers active in their jobs while taking advanced courses in human development may use records from their own classrooms for this course. May not be taken concurrently with H. D. Ed. 102, 103, or 104. (Staff.)

H. D. Ed. 260. Synthesis of Human Development Concepts. (3)

Prerequisites, H. D. Ed. 204, 206 and 208. A seminar wherein advanced students work toward a personal synthesis of their own concepts in human growth and development. Emphasis is placed on seeing the dynamic interrelations between all processes in the behavior and development of an individual. (Staff.)

H. D. Ed. 270. Seminars in Special Topics in Human Development. (2-6)

Prerequisite, consent of the instructor. An opportunity for advanced students to focus in depth on topics of special interest growing out of their basic courses in human development. (Staff.)

F. INDUSTRIAL EDUCATION

For Graduates and Advanced Undergraduates

Ind. Ed. 105. General Shop. (2)

Laboratory fee, \$5.00. Designed to meet needs in organizing and administering a secondary school general shop. Students are rotated through skill and knowledge developing activities in a variety of shop areas. (Staff.)

Ind. Ed. 140. (Ed. 140.) Curriculum, Instruction, and Observation. (3)

Major functions and specific contributions of Industrial Art Education; its relation to the general objectives of the junior and senior high schools; selection and organization of subject matter in terms of modern practices and needs; methods of instruction; expected outcomes; measuring results; professional standards. Twenty periods of observation. (Staff.)

Ind. Ed. 143. Industrial Safety Education I. (2)

This course deals briefly with the history and developing of effective safety programs in modern industry and treats causes, effects, and values of industrial safety education inclusive of fire prevention and hazard controls. (Staff.)

Ind. Ed. 144. Industrial Safety Education II. (2)

In this course exemplary safety practices are studied through conference discussions, group demonstrations, and organized plant visits to selected industrial situations. Methods of fire precautions and safety practices are emphasized. Evaluative criteria in safety programs are formulated. (Staff.)

Ind. Ed. 150. Training Aids Development. (3)

Study of the aids in common use as to their source and application. Special emphasis is placed on principles to be observed in making aids useful to shop teachers. Actual construction and application of such devices will be required. (Staff.)

Ind. Ed. 157. Tests and Measurements. (2)

Prerequisite, Ed. 150 or consent of instructor. The construction of objective tests for occupational and vocational subjects. (Staff.)

Ind. Ed. 161. Principles of Vocational Guidance. (2)

This course identifies and applies the underlying principles of guidance to the problems of educational and vocational adjustment of students. (Staff.)

Ind. Ed. 164. Shop Organization and Management. (2)

This course covers the basic elements of organizing and managing an industrial education program including the selection of equipment and the arrangement of the shop. (Staff.)

Ind. Ed. 165. Modern Industry. (2)

This course provides an overview of manufacturing industry in the American social, economic, and culture pattern. Representative basic industries are studied from the viewpoints of personnel and management organization, industrial relations, production procedures, distribution of products, and the like. (Staff.)

Ind. Ed. 166. Educational Foundations of Industrial Arts. (2)

A study of the factors which place industrial arts education in any well-rounded program of general education. (Staff.)

Ind. Ed. 167. Problems in Occupational Education. (2)

The purpose of this course is to secure, assemble, organize, and interpret data relative to the scope, character and effectiveness of occupational education. (Staff.)

Ind. Ed. 168. Trade or Occupational Analysis. (2)

Provides a working knowledge of occupational and job analysis which is basic in organizing vocational-industrial courses of study. This course should precede Ind. Ed. 169. (Staff.)

Ind. Ed. 169. Course Construction. (2)

Surveys and applies techniques of building and reorganizing courses of study for effective use in vocational and occupational schools. (Staff.)

Ind. Ed. 170. Principles of Vocational Education. (2)

The course develops the vocational education movement as an integral phase of the American program of public education. (Staff.)

Ind. Ed. 171. History of Vocational Education. (2)

An overview of the development of vocational education from primitive times to the present. (Staff.)

Ind. Ed. 175. Recent Technological Developments in Products and Processes. (3)

This course is designed to give the student an understanding of recent technological developments as they pertain to the products and processes of industry. The nature of the newer products and processes is studied as well as their effect upon modern industry and/or society. (Staff.)

For Graduates

Ind. Ed. 207. Philosophy of Industrial Arts Education. (3)

This course is intended to assist the student in his development of a point of view in regard to industrial arts and its relationship with the total educational program. He should, thereby, have a "yardstick" for appraising current procedures and proposals and an articulateness for his own professional area. (Staff.)

Education

Ind. Ed. 214. School Shop Planning and Equipment Selection. (3)

This course deals with principles involved in planning a school shop and provides opportunities for applying these principles. Facilities required in the operation of a satisfactory shop program are catalogued and appraised. (Staff.)

Ind. Ed. 216. Supervision of Industrial Arts. (2)

(Staff.)

Ind. Ed. 220. Organization, Administration, and Supervision of Vocational Education. (2)

This course surveys objectively the organization, administration, supervision, curricular spread and viewpoint, and the present status of vocational education. (Staff.)

Ind. Ed. 240. Research in Industrial Arts and Vocational Education. (2)

This is a course offered by arrangement for persons who are conducting research in the areas of industrial arts and vocational education. (Staff.)

Ind. Ed. 241. Content and Method of Industrial Arts. (3)

Various methods and procedures used in curriculum development are examined and those suited to the field of industrial arts education are applied. Methods of and devices for industrial arts instruction are studied and practiced. (Staff.)

Ind. Ed. 248. Seminar in Industrial Arts and Vocational Education. (2)

(Staff.)

G. MUSIC EDUCATION

For Graduates and Advanced Undergraduates

Mus. Ed. 128. Music for the Elementary Classroom Teacher. (2)

Prerequisite, Mus. 16 or consent of instructor. A study of the group activities and materials through which the child experiences music. The course is designed to aid both music specialists and classroom teachers. It includes an outline of objectives and a survey of instructional methods. (Grentzer, Henke.)

Mus. Ed. 129. Methods of Class Instrumental Instruction. (2)

Prerequisites, or concurrent registration in Mus. 80, 81. Organization of and techniques for teaching beginning instrumental classes in the public schools. Two one-hour laboratories and one lecture per week. (Berman.)

Mus. Ed. 132. Music in the Secondary School. (2)

Prerequisite, consent of instructor. A study of the vocal and instrumental programs in the secondary schools. A survey of the needs in general music and the relationship of music to the core curriculum. (Henke.)

Mus. Ed. 139. Music for the Elementary School Specialist. (2-3)

First semester. Prerequisite, senior standing. A survey of instructional materials; objectives; organization of subject matter; lesson planning; methods and procedures in singing, listening, rhythms, simple instruments, and creative activities for the music specialist in the elementary school. Twenty periods of observation will be required for three credits. (Henke.)

Mus. Ed. 163. Band Techniques and Administration. (2)

Prerequisites, Mus. 81 and 161. Two lectures and two laboratory hours per week. Intensive study of a secondary wind instrument and of rehearsal techniques. A survey of instructional materials, administrative procedures, and band pageantry will be included. (Henderson.)

Mus. Ed. 170. Methods and Materials for Class Piano Instruction. (2)

The study of the principles and techniques of teaching class piano. The following groups, beginning and advanced, will be used for demonstrations: elementary school children, junior and senior high school students, adults. Special emphasis will be placed on the analysis of materials. (De Vermond.)

Mus. Ed. 171. String Teaching in the Public Schools. (2)

A study of the problems of organizing and developing the string program in the public schools. Emphasis is placed on exploratory work in string instruments, on the study of teaching techniques, and on the analysis of music literature for solo, small ensembles, and orchestra. (Berman.)

Mus. Ed. 173. The Vocal Music Teacher and School Organization. (2)

Prerequisite, practice teaching or teaching experience. Study of the function of the vocal music teacher in the elementary and secondary schools. Students will serve as resource teachers for those enrolled in Mus. Ed. 139. Open to graduate students by permission of instructor. (Grentzer.)

Mus. Ed. 175. Methods and Materials in Vocal Music for the High School. (2)

Prerequisite, consent of instructor. A survey of suitable vocal and choral repertoire for the high school. Problems of diction, interpretation, tone production, and phrasing. The course is designed primarily for choral directors and teachers of voice classes. (Grentzer.)

Mus. Ed. 180. Instrumental Seminar. (2)

Prerequisite, consent of instructor. Problems in the music directing of public-school instrumental organizations. A study of representative orchestral, band, and small-ensemble scores, and of the teaching problems involved. (Jordan.)

For Graduates

Mus. Ed. 200. Research Methods in Music and Music Education. (3)

The application of methods of research to problems in the fields of music and music education. The preparation of bibliographies and the written exposition of research projects in the area of the student's major interest. (Grentzer.)

Mus. Ed. 201. Administration and Supervision of Music in the Public Schools. (3)

The study of basic principles and practices of supervision and administration with emphasis on curriculum construction, scheduling, budgets, directing of in-service teaching, personnel problems, and school-community relationships. (Grentzer.)

Mus. Ed. 204. Current Trends in Music Education (Seminar). (2)

A survey of current philosophies and objectives of music in the schools. The scope and sequence of the music curricula, vocal and instrumental, on the elementary and secondary levels. (Grentzer.)

Education

Mus. Ed. 205. Seminar in Vocal Music in the Elementary Schools. (2)

A comparative analysis of current methods and materials used in the elementary schools. A study of the music curriculum as a part of the total school program, and of the roles of the classroom teacher and the music specialist. (Grentzer.)

Mus. Ed. 206. Choral Conducting and Repertoire. (2)

The study and reading of choral literature of all periods, including the contemporary, suitable for use in school and community choruses. Style, interpretation, tone quality, diction, rehearsal and conducting techniques are analyzed. (Staff.)

Mus. Ed. 207. Seminar in Vocal Music in the Secondary Schools. (2)

A comparative analysis of current methods and materials used in teaching junior and senior high-school classes in general music, history and appreciation, theory, and voice; and in directing choral groups and community singing. (Grentzer.)

Mus. Ed. 208. The Teaching of Music Appreciation. (2)

A study of the objectives for the elementary and secondary levels; the techniques of directed listening, the presentation of theoretical and biographical materials, course planning, selection and use of audio-visual aids, and library materials, and the correlation between music and other arts. (Ulrich.)

Mus. Ed. 209. Seminar in Instrumental Music. (2)

A consideration of acoustical properties and basic techniques of the instruments. Problems of ensemble and balance, intonation, precision, and interpretation are studied. Materials and musical literature for orchestras, bands, and small ensembles are evaluated.

Mus. Ed. 210. Advanced Orchestration and Band Arranging. (Seminar) (2)

A study of arranging and transcription procedures in scoring for the orchestra and band. Special attention is given to the arranging problems of the instrumental director in the public schools. Prerequisite, Mus. 147 or the equivalent, or consent of the instructor. (Henderson.)

H. SCIENCE EDUCATION

Sci. Ed. 105. Workshop in Science for Elementary Schools. (2)

Laboratory fee, \$2.00. Designed to help teachers acquire general science understandings and to develop teaching materials for practical use in classrooms. Includes experiments, demonstrations, constructions, observations, field trips, and use of audio-visual materials. The emphasis is on content and method related to science units in common use in elementary schools. (Blough.)

I. SPECIAL EDUCATION

Sp. Ed. 170. Introduction to Special Education. (3)

Designed to give an understanding of the needs of all types of exceptional children, stressing preventive and remedial measures. (Haring.)

Sp. Ed. 171. Characteristics of Exceptional Children. (3-6)

A. Mentally Retarded. B. Gifted. Studies the diagnosis, etiology, physical, social, and emotional characteristics of exceptional children. Describes how the educational program should be modified to utilize the full capacity of these children. (Haring.)

Sp. Ed. 172. Education of Exceptional Children. (3-6)

A. Mentally Retarded. B. Gifted. Prerequisite, Sp. Ed. 171 or equivalent. Offers practical and specific methods of teaching exceptional children. Selected observation of actual teaching may be arranged. (Haring.)

Sp. Ed. 173. Curriculum for Exceptional Children. (3-6)

A. Mentally Retarded. B. Gifted. Prerequisite, Sp. Ed. 171 or equivalent. Examines the principles and objectives guiding curriculum for exceptional children; gives experience in developing curriculum for these children; studies various curricula currently in use. (Haring.)

Sp. Ed. 278. Seminar in Special Education. (2)

An overview of education of exceptional children. (Haring.)

ELECTRICAL ENGINEERING

Professors: CORCORAN, REED, WAGNER AND WEBER.

Associate Professor: PRICE.

Lecturers: CHU, FREEMAN, KATZIN, SCHUCHARD, TRENT AND VANDERSLICE.

A written qualifying examination is required of all candidates for the master's degree in electrical engineering. This examination is usually held the first Saturday in October. Off-campus and part-time students must have satisfactorily completed a minimum of nine semester hours of graduate course work before being admitted to the written qualifying examination. Full-time students having less than nine semester hours of graduate course work are permitted to take this examination by special arrangement. The student must have been admitted to the Graduate School (Electrical Engineering) before taking this examination.

Students working toward the Master of Science degree in Electrical Engineering must take a minimum of six semester hours of course work from resident professors of electrical engineering. Students working toward the Doctor of Philosophy degree must take a minimum of twenty-four semester hours of course work from resident professors of electrical engineering; students presenting a minor in electrical engineering must include at least six semester hours of electrical engineering from resident professors.

For Graduates and Advanced Undergraduates

E. E. 100. Alternating-Current Circuits. (4)

First semester. Three lectures and one laboratory period a week. Laboratory fee, \$4.00. Prerequisites, Math. 20, 21, Phys. 20, 21, and E.E. 1. Required of juniors in electrical engineering. Single- and polyphase-circuit analysis under sinusoidal and

Electrical Engineering

non-sinusoidal conditions of operation. Mesh-current and nodal methods of analysis. Harmonic analysis by the Fourier series method. Theory and design of tuned coupled circuits. (Price, Simons.)

E. E. 101. Engineering Electronics. (4)

Second semester. Three lectures and one laboratory period a week. Laboratory fee, \$4.00. Prerequisite, E. E. 100. Required of juniors in electrical engineering. Theory and applications of electron tubes and associated circuits with emphasis on equivalent-circuit and graphical analysis of audio amplifiers; theory of feedback amplifiers. (Price, Simons.)

E. E. 102. Alternating-Current Machinery. (4)

First semester. Three lectures and one laboratory period a week. Laboratory fee, \$4.00. Prerequisites, E. E. 65 and E. E. 100. Required of seniors in electrical engineering. The operating principles of alternating-current machinery considered from theoretical, design, and laboratory points of view. Synchronous generators and motors; single and polyphase transformers; three-phase induction generators and motors; single-phase induction motors. (Hodgins.)

E. E. 103. Engineering Analysis. (2)

Second semester. Two lectures a week. Prerequisite, E. E. 100. Analysis of physical systems with emphasis on the selection and application of appropriate mathematical methods. (Corcoran, Reed.)

E. E. 104. Communications. (3)

Second semester. Three lectures a week. Prerequisites, E. E. 60 and E. E. 100. Required of juniors in electrical engineering. Long-line theory applied to audio-frequency and ultra-high-frequency systems. Elements of filter theory; impedance matching; Maxwell's equations in rectangular and cylindrical coordinates; elements of wave-guide theory. (Reed.)

E. E. 105, 106. Radio Engineering. (4, 4)

First and second semesters. Three lectures and one laboratory period a week. Laboratory fee, \$4.00. Prerequisites, E. E. 101, E. E. 105. Required of seniors in electrical engineering. Characteristics of radio-frequency circuits including the design of tuned couple circuits and Class C amplifiers. Amplification, oscillation, modulation, and detection with particular emphasis on radio-frequency amplification and broadcast-range reception. Elements of wave propagation and antenna systems. (Wagner, Price.)

E. E. 107. Electrical Measurements. (4)

Second semester. Three lectures and one laboratory period a week. Laboratory fee, \$4.00. Prerequisites, E. E. 100 and Math. 64. Measurement and calibration techniques employing ballistic galvanometers, potentiometers, bridges, electromagnetic and cathode-ray oscillographs, watt-hour meters, and electronic instruments. (Thompson.)

E. E. 108. Electric Transients. (3)

First semester. Three lectures a week. Prerequisites, E. E. 101, Math. 64. Required of seniors in electrical engineering. Current, voltage, and power transients in lumped-parameter networks. Introduction and utilization of Laplace transforms. Emphasis on natural circuit behavior as obtained from step and impulse excitation. (Price, Simons.)

E. E. 109. Pulse Techniques. (3)

Second semester. Three lectures a week. Prerequisites, E. E. 108, Math. 64. Required of seniors in electrical engineering. Generation, shaping, amplification, and delay of non-sinusoidal wave-forms. Circuit design techniques and application to radar, television, and computers. (Simons, Schulman.)

E. E. 110. Transistor Circuitry. (3)

Second semester. Three lectures a week. Prerequisite, E. E. 101. P-n junction theory; point-contact and junction type transistors; transistor parameters; equivalent circuits; typical transistor amplifier and oscillator circuits. (Corcoran, Reed.)

E. E. 114. Applied Electronics. (3)

First and second semesters. Three lectures a week. Prerequisite, E. E. 101. Detectors and discriminators; gas tube characteristics and associated circuits; photoelectric tubes and associated circuits; rectifiers and regulators; vacuum tube instruments. (Staff.)

E. E. 115. Feedback Control Systems. (3)

Second semester. Three lectures a week. Prerequisites, E. E. 101 and E. E. 108. Servomechanisms and automatic regulators; investigations of electric, hydraulic, pneumatic, and mechanical elements; analysis of system differential equations and development of transfer functions; stability criteria. (Price.)

E. E. 116. Feedback Control Systems Laboratory. (1)

Second semester. One laboratory period a week. Laboratory fee, \$4.00. Prerequisite, E. E. 115 or concurrent registration in E. E. 115. Laboratory exercises involving some of the basic concepts of feedback control systems. (Price.)

E. E. 117. Power Transmission and Distribution. (3)

First semester. Three lectures a week. Prerequisite, concurrent registration in E. E. 102. Inductance and capacitance calculations of polyphase transmission lines on a per wire basis; effective resistance calculations and depth-of-penetration formula; generalized parameters of four-terminal networks and long-line theory applied to power distribution systems; use of transmission line charts. (Reed.)

E. E. 120. Electromagnetic Waves. (3)

Second semester. Three lectures a week. Prerequisite, Math. 64, senior standing in electrical engineering or physics. The basic mathematical theory of electromagnetic wave propagation employing Maxwell's equations in scalar and vector form and in generalized coordinates; application to wave-guide transmission; propagation in space. (Reed.)

E. E. 130. Electronic Analog Computers. (3)

First semester. Three lectures a week. Prerequisites, E. E. 101, Math. 64. Principles of electronic computers of the analog type. Analog computing components, operational amplifiers, d-c amplifiers, instrument servos, multipliers, and function generators. (Chu.)

E. E. 131. Electronic Digital Computers. (3)

Second semester. Three lectures a week. Prerequisites, E. E. 101, Math. 64. Principles of electronic computers of the digital type. Digital computing operations, basic computing and control circuits, logical design, arithmetic unit, memory systems, and control units. (Chu.)

E. E. 160, 161. Vacuum Tubes. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Math. 64, senior standing in electrical engineering or physics. Electron emission; laws of electron motion; space charge effects; noise in vacuum tubes; magnetic lenses; klystrons; magnetrons; photoelectric tubes; other special-purpose tubes. (Weber.)

For Graduates

E. E. 200. Symmetrical Components. (3)

First semester. Three lectures a week. Prerequisite, E. E. 102. Application of the method of symmetrical components to synchronous generators, transmission lines, transformers, static loads possessing mutual coupling, and induction motor loads. Complete network solutions in terms of symmetrical components. (Reed.)

E. E. 201. Electromagnetic Theory. (3)

Second semester. Three lectures a week. Prerequisite, E. E. 120 or E. E. 215. Theoretical analysis and engineering applications of Laplace's, Poisson's and Maxwell's equations. (Weber.)

E. E. 202, 203. Transients in Linear Systems. (3, 3)

First and second semesters. Three lectures a week. Prerequisite, undergraduate major in electrical or mechanical engineering or physics. Operational circuit analysis; the Fourier integral; transient analysis of electrical and mechanical systems and vacuum tube circuits by the Laplace transform method. (Wagner.)

E. E. 206, 207. Microwave Engineering. (3, 3)

First and second semesters. Three lectures a week first semester and two lectures and one laboratory period a week second semester. Laboratory fee, E. E. 207, second semester, \$4.00. Prerequisite, E. E. 201 or E. E. 216. Basic considerations in solving field problems by differential equations; circuit concepts and their validity at high frequency; propagation and reflection of electromagnetic waves; guided electromagnetic waves; high-frequency oscillators and tubes; radiation engineering. (Weber.)

E. E. 209. Stability in Power Systems. (3)

Second semester. Three lectures a week. Prerequisite, E. E. 200. An extension of symmetrical components. E. E. 200, as applied to power systems; study of the stability problem; the swing equation and its solution; the equal-area and Routh's criteria for stability; solutions of faulted three-phase networks; system design. (Reed.)

E. E. 212, 213. Servomechanisms. (3, 3)

First and second semesters. Three lectures a week. Prerequisite undergraduate major in electrical or mechanical engineering or physics. (It is desirable that the student should have had E. E. 202.). The design and analysis of regulatory systems, emphasizing servo-mechanisms. Regulatory systems are analyzed by means of the governing differential equations to provide background for more practical studies of frequency spectrum analysis. Characteristics of actual systems. (Price.)

E. E. 215, 216. Radio Wave Propagation. (3, 3)

First and second semesters. Three lectures a week. Prerequisite, undergraduate major in electrical engineering, physics, or mathematics. Maxwell's wave equation; concept

of retarded magnetic vector potential; propagation over plane earth; propagation over spherical earth; refraction; meteorological effects; complex antennas; air-to-air propagation; lobe modulation. (Reed.)

E. E. 218, 219. Signal Analysis and Noise. (3, 3)

First and second semesters. Three lectures a week. Prerequisite, undergraduate major in electrical engineering or physics. Fourier series and integrals; phase and frequency modulation; noise figures of linear systems; shot effect; power spectra; applications of correlation function; properties of noise. (Freeman.)

E. E. 220, 221. Theory of Communication. (3, 3)

First and second semesters. Three lectures a week. Prerequisite, E. E. 219. Measure of information and channel capacity; methods of describing random signals and circuit analysis involving those signals. The statistical theory of communication systems. Systems which are statistically optimum. (Weber.)

E. E. 222. Graduate Seminar. (1)

Second semester. Prerequisite, approved application for candidacy to the degree of Master of Science or Doctor of Philosophy in Electrical Engineering. Seminars are held on topics such as micro-wave engineering, radiation engineering, non-linear circuit analysis, tensor analysis, and other topics of current interest. Since the subject matter is continually changing, a student may receive a number of credits by re-registration. (Corcoran, Reed, Wagner, Weber.)

E. E. 230. Mathematics of Circuit Analysis.

First semester. Three lectures a week. Prerequisite, undergraduate major in electrical engineering or physics. The mathematics of circuit analysis, including determinants, matrices, complex variable, and the Fourier integral. (Vanderslice.)

E. E. 231. Active Network Analysis. (3)

Second semester. Three lectures a week. Prerequisite, E. E. 230. The complex frequency plane; conventional feedback amplifier theory; Bode's mathematical definitions of feedback and sensitivity; theorems for feedback circuits; stability and physical realizability of electrical networks; Nyquist's and Routh's criteria for stability. (Vanderslice.)

E. E. 232, 233. Network Synthesis. (3, 3)

First and second semesters. Three lectures a week. Prerequisite, E. E. 231 or equivalent. Design of driving-point and transfer impedance functions with emphasis on the transfer loss and phase of minimum-phase networks; flow diagrams; physical network characteristics, including relations existing between the real and imaginary components of network functions; modern methods of network synthesis. (Vanderslice.)

E. E. 235. Applications of Tensor Analysis. (3)

First semester. Three lectures a week. Prerequisite, E. E. 202 or E. E. 230. The mathematical background of tensor notation which is applicable to electrical engineering problems. Applications of tensor analysis to electric circuit theory and to field theory. (Wagner.)

E. E. 399. Electrical Engineering Research.

Prerequisite, approved application for candidacy to the degree of Master of Science or Doctor of Philosophy in Electrical Engineering. Six semester hours of credit in E. E.

399 are required of M.S. degree candidates and a minimum of eighteen semester hours is required of Ph.D. candidates. A thesis covering an approved research problem and written in conformity with the regulations of the Graduate School is a partial requirement for either the degree of Master of Science or the degree of Doctor of Philosophy in Electrical Engineering. (Graduate Staff.)

ENGLISH LANGUAGE AND LITERATURE

Professors: MURPHY, ALDRIDGE, BODE, HARMAN, MCMANAWAY (P.T.) AND ZEEVELD.

Associate Professors: COOLEY AND WEBER.

Assistant Professors: BEALL, LUTWACK AND MISH.

The Department of English offers graduate work leading to the degrees of Master of Arts and Doctor of Philosophy. Candidates normally take both major and minor work within the Department of English, but with permission students may take minor work in other departments.

Departmental requirements for the degree of Master of Arts include: (1) a reading knowledge of French or German; (2) Eng. 201; (3) 3 credits from the following: Eng. 101, 102, 107, 202; (4) a written examination on English and American literature.

Departmental requirements for the degree of Doctor of Philosophy include: (1) a reading knowledge of French and German; (2) 6 credits from the following: Eng. 102, 202, 203; (3) an oral qualifying examination (normally waived for University of Maryland Masters of Arts in English), to be taken in the first year of residence after the master's degree or its equivalent; (4) a comprehensive written examination on English and American literature.

For Graduates and Advanced Undergraduates

Eng. 101. History of the English Language. (3)
Second semester; summer session (2). (Harman.)

Eng. 102. Old English. (3)
First semester; summer session (2). (Ball.)

Eng. 103. Beowulf. (3)
Second semester. (Ball.)

Eng. 104. Chaucer. (3)
First semester; summer session (2). (Harman.)

Eng. 107. American English. (3)
Second semester. (Ball.)

Eng. 110, 111. Elizabethan and Jacobean Drama. (3, 3)
(Not offered 1959-1960.) (Zeeveld, Mish.)

Eng. 112. The Poetry of the Renaissance. (3)
First semester. (Zeeveld.)

- Eng. 113. *Prose of the Renaissance*. (3)
Second semester. (Zeeveld, Mish.)
- Eng. 115, 116. *Shakespeare*. (3, 3)
First and second semesters; summer session (2, 2). (Zeeveld.)
- Eng. 120. *English Drama from 1660 to 1800*. (3)
Second semester. (Ward.)
- Eng. 121. *Milton*. (3)
Second semester; summer session (2). (Murphy.)
- Eng. 122. *Literature of the Seventeenth Century, 1600-1660*. (3)
First semester. (Murphy.)
- Eng. 123. *Literature of the Seventeenth Century, 1660-1700*. (3)
Second semester. (Aldridge.)
- Eng. 125, 126. *Literature of the Eighteenth Century*. (3, 3)
First and second semesters. Eng. 125, summer session (2). (Aldridge.)
- Eng. 129, 130. *Literature of the Romantic Period*. (3, 3)
First and second semesters; summer session (2, 2). (Weber.)
- Eng. 134, 135. *Literature of the Victorian Period*. (3, 3)
First and second semesters; summer session (2, 2). (Cooley.)
- Eng. 139, 140. *The English Novel*. (3, 3)
First and second semesters; Eng. 140, summer session (2). (Ward, Mish.)
- Eng. 143. *Modern Poetry*. (3)
First semester; summer session (2). (Fleming.)
- Eng. 144. *Modern Drama*. (3)
First semester. (Weber.)
- Eng. 145. *The Modern Novel*. (3)
Second semester. (Andrews.)
- Eng. 148. *The Literature of American Democracy*. (3)
Second semester. (Bode.)
- Eng. 150, 151. *American Literature*. (3, 3)
First and second semesters; summer session (2, 2). (Manning, Gravely, Lutwack.)
- Eng. 155, 156. *Major American Writers*. (3, 3)
First and second semesters; summer session (2, 2). (Gravely, Manning.)
- Eng. 157. *Introduction to Folklore*. (3)
First semester; summer session (2). (Cooley.)

English Language and Literature

- Eng. 160. Advanced Expository Writing. (3)*
Second semester. Prerequisite, permission of the instructor. (Walker.)
- Eng. 170. Creative Writing. (2)*
First semester. Prerequisite, permission of the instructor. (Fleming.)
- Eng. 171. Advanced Creative Writing. (2)*
Second semester. Prerequisite, permission of the instructor. (Fleming.)
- Eng. 172. Playwriting. (2)*
Second semester. Prerequisite, permission of the instructor. (Fleming.)

For Graduates

- Eng. 201. Bibliography and Methods. (3)*
First semester. (Mish.)
- Eng. 202. Middle English. (3)*
First semester; summer session (2). (Harman.)
- Eng. 203. Gothic. (3)*
Second semester. (Harman.)
- Eng. 204. Seminar in Medieval Literature. (3)*
Second semester. (Cooley.)
- Eng. 206, 207. Seminar in Renaissance Literature. (3, 3)*
First and second semesters; Eng. 206, summer session (2). (McManaway, Zeeveld.)
- Eng. 210. Seminar in Seventeenth Century Literature. (3)*
Second semester; summer session (2). (Murphy, Mish.)
- Eng. 212, 213. Seminar in Eighteenth Century Literature. (3, 3)*
(Not offered 1959-1960.) (Aldridge.)
- Eng. 214, 215. Seminar in Nineteenth Century Literature. (3, 3)*
First and second semesters; Eng. 214, summer session (2). (Cooley, Weber.)
- Eng. 216, 217. Literary Criticism. (3, 3)*
First and second semesters. (Murphy, Lutwack.)
- Eng. 225, 226. Seminar in American Literature. (3, 3)*
First and second semesters; summer session (2, 2). (Bode.)
- Eng. 227, 228. Problems in American Literature. (3, 3)*
First and second semesters; Eng. 227, summer session (2). (Aldridge.)
- Eng. 399. Thesis Research. (1-6)*
Arranged. (Staff.)

ENTOMOLOGY

Professors: BICKLEY, DITMAN AND LANGFORD.

Associate Professor: JONES.

Assistant Professor: HAVILAND.

Lecturer: SAILER.

The Department of Entomology offers work toward the degree of Master of Science and Doctor of Philosophy. Candidates for the Ph.D. degree who are not employed by the Department are expected to register for a minimum of 24 semester hours credit during two semesters at College Park.

For Graduates and Advanced Undergraduates

Ent. 100. Advanced Apiculture. (3)

Second semester. One lecture and two three-hour laboratory periods a week. Prerequisite, Ent. 4. Laboratory fee, \$3.00. The theory and practice of apiary management. Designed for the student who wishes to keep bees or requires a practical knowledge of bee management. (Abrams.)

Ent. 105. Medical Entomology. (3)

First semester. Two lectures and one two-hour laboratory period a week. Prerequisite, Ent. 1, or consent of the Department. Laboratory fee, \$3.00. A study of insects and related arthropods that affect the health and comfort of man directly and as vectors of disease. In discussions of the control of such pests the emphasis will be upon community sanitation. (Jones.)

Ent. 107. Insecticides. (2)

Second semester. Prerequisite, consent of the Department. The development and use of contact and stomach poisons, fumigants and other important chemicals, with reference to their chemistry, toxic action, compatibility, and host injury. Recent research emphasized. (Shepard.)

Ent. 109. Insect Physiology. (2)

Second semester. Two lectures and occasional demonstrations. Prerequisite, consent of the Department. The functioning of the insect body with particular reference to blood, circulation, digestion, absorption, excretion, respiration, reflex action and the nervous system, and metabolism. (Jones.)

Ent. 115. Quarantine Procedures. (2)

Second semester. Prerequisite, consent of the Department. Lectures on the principles and procedures involved in preventing the introduction of foreign pests and the limitation of spread of endemic or introduced pests. (Johnson.)

Ent. 116. Insect Pests of Ornamentals and Greenhouse Plants. (3)

Second semester. Two lectures and one two-hour laboratory period a week. Prerequisite, Bot. 1 and Zool. 1. Laboratory fee, \$3.00. The recognition, biology, and control of insects injurious to plants grown in ornamental plantings, nurseries, and under glass. (Haviland.)

Entomology

Ent. 119. Insect Pests of Domestic Animals. (2)

First semester. One lecture and one two-hour laboratory period a week. Prerequisite, Ent. 1 or consent of the Department. Laboratory fee, \$3.00. The recognition, biology, and control of insects and related arthropods injurious to horses, cattle, hogs, sheep, goats, and poultry. (Haviland.)

Ent. 120. Insect Taxonomy and Biology. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Prerequisite, Ent. 1. Laboratory fee, \$3.00. Introduction to the principles of systematic entomology and the study of all orders and the important families of insects; immature forms considered. (Bickley.)

Ent. 198. Special Problems. (1-3)

First and second semesters. Credit and prerequisites, to be determined by the Department. Investigations of assigned entomological problems. (Staff.)

Ent. 199. Seminar. (1, 1)

First and second semesters. Prerequisite, senior standing. Presentation of original work, reviews and abstracts of literature. (Staff.)

For Graduates

Ent. 203. Advanced Insect Morphology. (3)

Second semester. One lecture and two three-hour laboratory periods a week. Laboratory fee, \$3.00. Insect structure with special reference to function. Given in preparation for advanced work in physiology or research in morphology. (Haviland.)

Ent. 205. Insect Ecology. (2)

First semester. One lecture and one two-hour laboratory period a week. Prerequisite, consent of the Department. Laboratory fee, \$3.00. A study of fundamental factors involved in the relationship of insects to their environment. Emphasis is placed on the insect as a dynamic organism adjusted to its surroundings. (Sailer.)

Ent. 206. Culicidology. (2)

Second semester. One lecture and one three-hour laboratory period a week. Laboratory fee, \$3.00. (Alternate years; not offered in 1960-1961). The classification, distribution, ecology, biology, and control of mosquitoes. (Bickley.)

Ent. 207. Advanced Insect Physiology. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Prerequisite, one year of organic chemistry and Ent. 109 or equivalent. In this course students rear experimental insects, make up reagents and solutions to be used, set up equipment, calibrate it, and make detailed measurements and observations on the functions of selected organ systems. (Jones.)

Ent. 301. Advanced Entomology. (1-6)

Credit and prerequisites to be determined by the Department. First and second semesters. Studies of minor problems in morphology, physiology, taxonomy and applied entomology, with particular reference to the preparation of the student for individual research. (Staff.)

Ent. 399. *Research.*

First and second semesters. Required of graduate students majoring in entomology. This course involves research on an approved project. A dissertation suitable for publication must be submitted at the conclusion of the studies as a part of the requirements for an advanced degree. (Staff.)

FOREIGN LANGUAGES AND LITERATURE

Professors: ZUCKER, FALLS, GOODWYN, PRAHL AND SMITH.

Associate Professors: PARSONS AND QUINN.

Assistant Professors: RAND AND ROSENFELD.

Master of Arts

Candidates must pass, in addition to written examinations in the courses pursued, a written examination based on the reading lists in their respective fields of French, German and Spanish, established by the Department. The examination will test the general familiarity of the candidate with his respective field and his powers of analysis and criticism. The oral examination will deal chiefly with the field of his thesis.

Doctor of Philosophy

Candidates must pass a comprehensive written examination at least three months before the degree is awarded. This examination will include linguistics and each of the major literary fields.

Attention is called to the courses in Comparative Literature listed on pages 66-67.

A. FRENCH

For Graduates and Advanced Undergraduates

French 0. Intensive Elementary French. (0)

Summer session only. Graduate students should register as auditors only. Intensive elementary course in the French language designed particularly for graduate students who wish to acquire a reading knowledge. (Kramer.)

French 100. French Literature of the Sixteenth Century. (3)

First semester. The Renaissance in France; humanism; Rabelais and Calvin; the Pleiade; Montaigne. (Falls.)

French 101, 102. French Literature of the Seventeenth Century. (3, 3)

First and second semesters. First semester: Descartes, Pascal, Corneille, Racine. Second semester: the remaining great classical writers, with special attention to Moliere. (Quinn, Rosenfeld.)

Foreign Languages and Literature

French 103, 104. French Literature of the Eighteenth Century. (3, 3)

First and second semesters. First semester: development of the philosophical and scientific movement; Montesquieu. Second semester: Voltaire, Diderot, Rousseau.
(Falls, Bingham.)

French 105, 106. French Literature of the Nineteenth Century. (3, 3)

First and second semesters. First semester: drama and poetry from Romanticism to Symbolism. Second semester: the major prose writers of the same period.
(Bingham, Quynn.)

French 107, 108. French Literature of the Twentieth Century. (3, 3)

First and second semesters. First semester: drama and poetry from Symbolism to the present time. Second semester: the contemporary novel.
(Falls.)

French 121, 122. Advanced Composition. (3, 3)

First and second semesters. Translation from English into French, free composition, letter writing.
(Falls.)

French 161, 162. French Civilization. (3, 3)

First and second semesters. French life, customs, culture, traditions. First semester: the historic development. Second semester: present-day France.
(Rosenfield, Bingham.)

French 171. Practical French Phonetics. (3)

First semester. Pronunciation of modern French. The sounds and their production, the stress group, intonation.
(Smith.)

French 199. Rapid Review of the History of French Literature. (1)

Second semester. Especially designed for French majors. Weekly lectures stressing the leading concepts in the history of French literature.
(Falls.)

For Graduates

The requirements of students will determine which courses will be offered.

French 207, 208. The French Novel in the First Half of the Nineteenth Century. (2, 2)

First and second semesters. First semester: Chateaubriand to Dumas. Second semester: Stendhal to Merimee.
(Falls.)

French 209, 210. The French Novel in the Second Half of the Nineteenth Century. (2, 2)

First and second semesters. First semester: Flaubert to Valles. Second semester: Huysmans to A. France.
(Falls.)

French 211. French Linguistics. (3)

First semester. The development of the French language from its origins in Latin.
(Smith, Bulatkin.)

French 212. Old French Readings. (3)

Second semester. Reading of texts in Old French with emphasis on the literature as an expression of medieval culture.
(Smith, Bulatkin.)

French 215, 216. Moliere. (3, 3)

First and second semesters. Moliere's plays considered in the development of French comedy. (Quynn.)

French 221, 222. Reading Course.

(Arranged.) Designed to give the graduate student a background of a survey of French literature. (Staff.)

French 230. Introduction to European Linguistics. (3)

Linguistic problems considered on the basis of several languages. (Smith, Bulatkin.)

French 251, 252. Seminar. (3, 3)

Required of all graduate majors in French. (Staff.)

French 399. Research.

Credits determined by work accomplished.

B. GERMAN

For Graduates and Advanced Undergraduates

German 0. Intensive Elementary German. (0)

Summer session only. Graduate students should register as auditors only. Intensive elementary course in the German language designed particularly for graduate students who wish to acquire a reading knowledge. (Kramer.)

German 101, 102. German Literature of the Eighteenth Century. (3, 3)

First and second semesters. The main works of Klopstock, Wieland, Lessing, Herder, Goethe, Schiller. (Prah, Schweizer.)

German 103, 104. German Literature of the Nineteenth Century. (3, 3)

First and second semesters. Outstanding works of Kleist, Grillparzer, Grabbe, Hebbel, Ludwig, Stifter, Keller, Anzengruber. (Prah, Schweizer.)

German 105, 106. Modern German Literature. (3, 3)

First and second semesters. Prose and dramatic writings from Gerhart Hauptmann to the present time (1890-1950.) (Prah, Dobert.)

German 107, 108. Goethe's Faust. (2, 2)

First and second semesters. First and second parts of the drama. (Hering.)

German 121, 122. Advanced Composition. (3, 3)

First and second semesters. Translations from English into German, free composition, letter writing. (Kramer, Dobert.)

German 161, 162. German Civilization. (3, 3)

First and second semesters. A survey of two thousand years of German history, outlining the cultural heritage of the German people, their great men, tradition, customs, art and literature, with special emphasis on the interrelationship of social and literary history. (Prah.)

Foreign Languages and Literature

German 199. Rapid Review of the History of German Literature. (1)

Second semester. Especially designed for German majors. Weekly lectures stressing the leading concepts in the history of German literature. (Schweizer.)

Attention is called to Comp. Lit. 106, *Romanticism in Germany*, and Comp. Lit. 107, *The Faust Legend in English and German Literature*.

For Graduates

The requirements of students will determine which courses will be offered.

German 202, 203. The Modern German Drama. (3, 3)

First and second semesters. Study of dramas from Hauptmann to Zuckmeyer. (Zucker.)

German 204. Schiller. (3)

Study of Schiller's works with emphasis on his dramas. (Pahl.)

German 205. Goethe's Works outside of Faust. (2)

Particular attention given to Goethe's lyrics and novels. (Zucker.)

German 206. The Romantic Movement. (3)

Special consideration given to the ideas and the style of romantic writers. (Pahl.)

German 221, 222. Reading Course.

(Arranged). First and second semesters. Designed to give the graduate student a background of a survey of German literature. (Staff.)

German 230. Introduction to European Linguistics. (3)

First semester. Linguistic problems considered on the basis of several languages. (Smith, Bulatkin.)

German 231. Middle High German. (3)

Second semester. Walther von der Vogelweide, the Nibelungenlied, Wolfgang von Eschenbach. (Schweizer.)

German 251, 252. Seminar. (3, 3)

Required of all graduate majors in German. (Staff.)

German 399. Research.

Credits determined by work accomplished.

C. SPANISH

For Graduates and Advanced Undergraduates

Spanish 101. Epic and Ballad. (3)

First semester. The legendary and heroic matter of Spain. Readings of the *Poema del Cid* and of ballads of various cycles. (Parsons.)

Spanish 102. The Spanish Popular Ballad. (3)

Second semester. Typical ballads composed and developed in the Spanish-speaking world during and since the Golden Age, with stress on the folkloristic point of view. (Goodwyn.)

Spanish 104. The Drama of the Golden Age. (3)

Second semester. Selected plays of Lope de Vega, Calderon de la Barca, Tirso de Molina and others. (Parsons.)

Spanish 107. Cervantes: Plays and Exemplary Novels. (3)

First semester. (Rand.)

Spanish 108. Lope de Vega. (3)

First semester. Selected works of Lope de Vega. (Parsons.)

Spanish 109. Cervantes: Don Quijote. (3)

Second semester. (Goodwyn.)

Spanish 110. Modern Spanish Poetry. (3)

First semester. Significant poems of the nineteenth and twentieth centuries. (Rand.)

Spanish 111. The Spanish Novel of the Nineteenth Century. (3)

First semester. Readings of some of the significant novels of the nineteenth century. (Parsons.)

Spanish 112. Modern Spanish Drama. (3)

Second semester. Significant plays of the nineteenth and twentieth centuries. (Nemes.)

Spanish 113. The Spanish Novel of the Twentieth Century. (3)

Second semester. Significant novels of the twentieth century. (Rand.)

Spanish 115. Modern Spanish Thought. (3)

First semester. The generation of 1898 and other significant and interpretative writings of the twentieth century. (Rand.)

Spanish 121, 122. Advanced Composition. (3, 3)

First and second semesters. Training in self-expression in Spanish, free composition, letter writing. (Goodwyn.)

Spanish 151. Spanish-American Novel. (3)

First semester. The novel and short story from the Wars of Independence to the present and their reflection of society in the republics of the Western Hemisphere. (Nemes.)

Spanish 152. Spanish-American Poetry. (3)

Second semester. Representative poetry after 1800 and its relation to European trends and writers. (Nemes.)

Spanish 153. Spanish-American Essay. (3)

First or second semester. Social and political thought from Bolivar to Vasconcelos and its relationship to social and political conditions in Spanish America. (Nemes.)

Spanish 161, 162. Spanish Civilization. (3, 3)

First and second semesters. Introductory study of the literary, educational, artistic traditions; great men, customs, and general culture. (Rand.)

Foreign Languages and Literature

Spanish 163, 164. Latin-American Civilization. (3, 3)

First and second semesters. Introductory study of the cultures of Latin America; the historical-political background and the dominating concepts in the lives of the people.
(Goodwyn.)

Spanish 199. Rapid Review of the History of Spanish Literature. (1)

Second semester. Especially designed for Spanish majors. Weekly lectures stressing the leading concepts in the history of Spanish literature.
(Parsons.)

For Graduates

Spanish 202. The Golden Age in Spanish Literature. (3)

First semester. Intensive study of selected classics.
(Goodwyn.)

Spanish 203, 204. Spanish Poetry. (3, 3)

First and second semesters. First semester: poetry of the Golden Age. Second semester: romantic and modern poetry.
(Goodwyn.)

Spanish 205, 206. Spanish Literature of the Twentieth Century. (3, 3)

First and second semesters. First semester: significant works of Angel Ganivet, Unamuno, Pio Baroja. Second semester: Azorin, Valle Inclan, Antonio Machado.
(Rand.)

Spanish 211. Spanish Linguistics. (3)

First semester. The development of the Spanish language from its origins in Latin.
(Parsons, Bulatkin.)

Spanish 212. Old Spanish Readings. (3)

Second semester. Reading of texts in Old Spanish, with emphasis on the literature as an expression of medieval culture.
(Parsons, Bulatkin.)

Spanish 221, 222. Reading Course.

(Arranged). Designed to give the graduate student a background of a survey of Spanish literature.
(Staff.)

Spanish 230. Introduction to European Linguistics. (3)

Linguistic problems considered on the basis of several languages.
(Smith, Bulatkin.)

Spanish 251, 252. Seminar. (3, 3)

Required of all graduate majors in Spanish.
(Staff.)

Spanish 399. Research.

Credit determined by work accomplished.

D. RUSSIAN

For Graduates and Advanced Undergraduates

Russian 101, 102. Modern Russian Literature. (3, 3)

First and second semesters. Works of Maxim Gorky, Alexei Tolstoy, P. Romanov, M. Zoshchenko, M. Sholokhov.
(Boborykine.)

Russian 103, 104. Russian Literature of the Nineteenth Century. (3, 3)

First and second semesters. Selected writings of Pushkin, Gogol, Lermantov, Turgenev, Dostoevsky, Leo Tolstoy, Chekhov. (Boborykine.)

E. CHINESE

Chinese 101, 102. Readings from Chinese History. (3, 3)

First and second semesters. Based on an anthology of historians from the Chou to the Ching dynasties. (Chen.)

Chinese 161, 162. Chinese Civilization. (3, 3)

First and second semesters. This course supplements Geography 134 and 135, *Cultural Geography of East Asia*. It deals with Chinese literature, art, folklore, history, government, and great men. Second semester: developments in China since 1911. Chinese 161 and 162 may be counted as history credits in meeting major and minor requirements. (Chen.)

F. HEBREW

Hebrew 101. The Hebrew Bible. (3)

Reading of selected portions of the Pentateuch. (Greenberg.)

Hebrew 102. The Hebrew Bible. (3)

Reading of selected portions of the Prophets. (Greenberg.)

Hebrew 103. Modern Hebrew Literature. (3)

The period of the Haskalah (Enlightenment). (Greenberg.)

Hebrew 104. Modern Hebrew Literature. (3)

The period of the Tehiah (Modern Revival). (Greenberg.)

GEOGRAPHY

Professors: VAN ROYEN AND HU.

Consulting Professor: ROTERUS.

Lecturers with rank of Professor: LEMONS AND MCBRYDE.

Associate Professor: AUGELLI.

Students seeking graduate degrees in geography are expected to have acquired a broad foundation in the subject and in allied fields. This foundation must have included a minimum of 24 semester hours in geography, of which 6 semester hours shall have been in morphology and map reading and interpretation, 6 semester hours in weather and climate, and 12 semester hours in human, economic, or regional geography. In addition the student must have taken successfully the following courses, or their equivalents, in allied fields: Anthropology (3 semester hours), Economics (6 semester hours), History (6 semester hours), Introductory or General Botany (3 semester hours), Sociology (3 semester hours), Foreign Language (12 semester hours). Students who do

not have this background will be accepted as graduate students in a provisional status only and will be required to make up their deficiencies before being admitted to candidacy for an advanced degree. Graduate credit will not be given for courses taken to make up for deficiencies in background.

In addition to meeting the general requirements of the Graduate School, candidates for the master's degree in geography are required to have taken successfully: one field course (Geog. 170 or 200, or equivalent), a course in cartography, a course in soils, and one seminar. In addition to the final oral examination, the candidate for the master's degree in geography is required to pass satisfactorily a written examination covering the field in which he has worked, his understanding of basic principles, and his power of reasoning.

A graduate student seeking the Doctor of Philosophy degree in Geography must take a comprehensive written and oral examination to determine whether he has sufficiently broad and profound knowledge and understanding of the entire field of geography to qualify as a candidate for the doctor's degree.

Geog. 100. Regional Geography of Eastern Anglo-America. (3)

Second semester, alternate years. Prerequisite, Geog. 1, 2 or Geog. 10. or permission of instructor. A study of the cultural and economic geography, and the geographic regions of Eastern United States and Canada, including an analysis of the significance of the physical basis for present-day diversification of development, and the historical geographic background. (McArthur.)

Geog. 101. Regional Geography of Western Anglo-America. (3)

Second semester, alternate years. Prerequisite, Geog. 1, 2 or Geog. 10 or permission of instructor. A study of Western United States, Western Canada, and Alaska along the lines mentioned under Geog. 100. (McArthur.)

Geog. 103. Geographic Concepts and Source Materials. (2)

First or second semester. A comprehensive and systematic survey of geographic concepts designed exclusively for teachers. Stress will be placed upon the philosophy of geography in relation to the social and physical sciences, the use of the primary tools of geography, source materials, and the problems of presenting geographic principles. (Staff.)

Geog. 104. Geography of Major World Regions. (2)

First or second semester. A geographic analysis of the patterns, problems, and prospects of the world's principal human-geographic regions, including Europe, Anglo-America, the Soviet Union, the Far East, and Latin America. Emphasis upon the causal factors of differentiation and the role geographic differences play in the interpretation of the current world scene. This course is designed especially for teachers. (Staff.)

Geog. 105. Geography of Maryland and Adjacent Areas. (3)

First or second semester. An analysis of the physical environment, natural resources, and population in relation to agriculture, industry, transport, and trade in the state of Maryland and adjacent areas. (Staff.)

Geog. 110. Economic and Cultural Geography of Caribbean America. (3)

First semester. An analysis of the physical framework, broad economic and historical trends, cultural patterns, and regional diversification of Mexico, Central America, the West Indies, and parts of Colombia and Venezuela. (Augelli.)

Geog. 111. Economic and Cultural Geography of South America. (3)

Second semester. A survey of natural environment and resources, economic development, and cultural diversity of the South American republics, with emphasis upon problems and prospects of the countries. (Augelli.)

Geog. 120. Economic Geography of Europe. (3)

First semester. The natural resources of Europe in relation to agricultural and industrial development and to present-day economic and national problems. (Van Royen, Hooson.)

Geog. 122. Economic Resources and Development of Africa. (3)

First or second semester. The natural resources of Africa in relation to agricultural and mineral production; the various stages of economic development and the potentialities of the future. (Deshler.)

Geog. 123. Problems of Colonial Geography. (3)

First or second semester. Problems of development of colonial areas, with special emphasis upon the development of tropical regions and the possibilities of white settlement in the tropics. (Staff.)

Geog. 130, 131. Economic and Political Geography of Southern and Eastern Asia. (3, 3)

First and second semesters, alternate years with Geog. 134, 135. A study of China, Japan, India, Burma, Indo-China and the East Indies; natural resources, population and economic activities. Comparisons of physical and human potentialities of major regions and of their economic, social, and political development. (Hu.)

Geog. 134, 135. Cultural Geography of East Asia. (3, 3)

First and second semesters, alternate years with Geog. 130, 131. A comprehensive and systematic survey of the geographical distribution and interpretation of the major racial groups and cultural patterns of China, Japan, and Korea. Special emphasis will be placed on the unique characteristics of the peoples of these areas, their basic cultural institutions, outlooks on life, contemporary problems, and trends of cultural change. Designed especially for students of the social sciences, and those preparing for careers in foreign service, foreign trade, education, and international relations. (Hu.)

Geog. 140. Soviet Lands. (3)

First or second semester. The natural environment and its regional diversity. Geographic factors in the expansion of the Russian state. The geography of agricultural and industrial production, in relation to available resources, transportation problems, and diversity of population. (Hooson.)

Geog. 146. The Near East. (3)

First semester. The physical, economic, political, and strategic geography of the lands between the Mediterranean and India. (Staff.)

Geography

Geog. 150. *History and Theory of Cartography.* (3)

Second semester. The development of maps throughout history, geographical orientation, coordinates, and map scales. Map projections, their nature, use, and limitations. Principles of representation of features on physical and cultural maps. Modern uses of maps and relationships between characteristics of maps and use types. (McBryde.)

Geog. 151, 152. *Cartography and Graphics Practicum.* (3, 3)

First and second semesters. One hour lecture and two two-hour laboratory periods a week. Techniques and problems of compilation, design, and construction of various types of maps and graphs. Relationships between map making and modern methods of production and reproduction. Trips to representative plants. Laboratory work directed toward cartographic problems encountered in the making of non-topographic maps. (Karinen.)

Geog. 153. *Problems in Cartographic Representation and Procedure.* (3)

First or second semester. Two hours lecture and two hours laboratory a week. Study of cartographic compilation methods. Principles and problems of symbolization, classification, and representation of map data. Problems of representation of features at different scales and for different purposes. Place-name selection and lettering; stick-up and map composition. (Karinen.)

Geog. 154. *Problems of Map Evaluation.* (3)

First or second semester. Two hours lecture and two hours laboratory a week. Schools of topographic concepts and practices. Theoretical and practical means of determining map reliability, map utility, and source materials. Nature, status, and problems of topographic mapping in different parts of the world. Non-topographic special use maps. Criteria of usefulness for purposes concerned and of reliability. (Karinen.)

Geog. 155. *Problems and Practices of Photo Interpretation.* (3)

First or second semester. Two hours of lecture and two hours of laboratory per week. Interpretation of aerial photographs with emphasis on the recognition of landforms of different types and man-made features. Study of vegetation, soil, and other data that may be derived from aerial photographs. Types of aerial photographs and limitations of photo interpretation. (Ahnert.)

Geog. 160. *Advanced Economic Geography I. Agricultural Resources.* (3)

First semester, alternate years. Prerequisite, Geog. 1 and 2, or Geog. 10. The nature of agricultural resources, the major types of agricultural exploitation in the world, and the geographic distribution of certain major crops and animals in relation to the physical environment and economic geographic conditions. Main problems of conservation. (Van Royen.)

Geog. 161. *Advanced Economic Geography II. Mineral Resources.* (3)

First semester, alternate years. Prerequisite, Geog. 1 and 2, or Geog. 10. The nature and geographic distribution of the principal power, metallic, and other minerals. Economic geographic aspects of modes of exploitation. Consequences of geographic distribution and problems of conservation. (Van Royen.)

Geog. 170. *Local Field Course.* (3)

First semester. Training in geographic field methods and techniques. Field observation of land use in selected rural and urban areas in eastern Maryland. One lecture

per week with Saturday and occasional weekend field trips. Primarily for undergraduates. (Ahnert.)

Geog. 180. History, Nature and Methodology of Geography. (3)

First semester. A comprehensive and systematic study of the history, nature, and basic principles of geography, with special reference to the major schools of geographic thought; a critical evaluation of some of the important geographical works and methods of geographic research. (Hu.)

Geog. 190. Political Geography. (3)

Second semester. Geographical factors in national power and international relations; an analysis of the role of "Geopolitics" and "Geostrategy", with special reference to the current world scene. (Augelli.)

Geog. 195. Geography of Transportation. (3)

Second semester. The distribution of transport routes on the earth's surface; patterns of transport routes; the adjustment of transport routes and media to conditions of the natural environment; transportation centers and their distribution. (Staff.)

Geog. 197. Urban Geography. (3)

First semester. Origins of cities, followed by a study of the elements of site and location with reference to cities. The patterns and functions of some major world cities will be analyzed. Theories of land use differentiation within cities will be appraised. (McArthur.)

Geog. 199. Topical Investigations. (1-3)

First and second semesters. Restricted to advanced undergraduate students with credit for at least 24 hours of geography. Independent study under individual guidance. Choice of subject matter requires joint approval of advisor and Head of the Department of Geography. (Staff.)

For Graduates

Geog. 200. Field Course. (3)

Field work in September, conferences and reports during first semester. For graduate students in geography. Open to other students by special permission of the Head of the Department of Geography. Practical experience in conducting geographic field studies. Intensive training in field methods and techniques and in the preparation of reports. For graduate students in geography. Open to other students by special permission of the Head of the Department of Geography. (Staff.)

Geog. 210, 211. Seminar in the Geography of Latin America. (3, 3)

First and second semesters. Prerequisites, Geog. 110, 111 or consent of instructor. An analysis of recent changes and trends in industrial development, exploitation of mineral resources and land utilization. (McBryde.)

Geog. 220, 221. Seminar in the Geography of Europe and Africa. (3, 3)

First and second semesters. Prerequisites, Geog. 120, 122 or consent of instructor. Analysis of special problems concerning the resources and development of Europe and Africa. (Van Royen, Deshler.)

Geography

Geog. 230, 231. *Seminar in the Geography of East Asia.* (3, 3)

First and second semesters. Analysis of problems concerning the geography of East Asia with emphasis on special research methods and techniques applicable to the problems of this area. (Hu.)

Geog. 240, 241. *Seminar in the Geography of the U.S.S.R.* (3, 3)

First and second semesters. Prerequisites, reading knowledge of Russian and Geog. 140 or consent of instructor. Investigation of special aspects of Soviet geography. Emphasis on the use of Soviet materials. (Hooson.)

Geog. 246. *Seminar in the Geography of the Near East.* (3)

(Staff.)

Geog. 250. *Seminar in Cartography.*

(Credit to be arranged.) First or second semester. The historical and mathematical background of cartographic concepts, practices and problems, and the various philosophical and practical approaches to cartography. Discussions will be supplemented by the presentation of specific cartographic problems investigated by the students.

(McBryde, Karinen.)

Geog. 260. *Advanced General Climatology.* (3)

First semester. Prerequisite, Geog. 41, or consent of instructor. Advanced study of elements and controls of the earth's climates. Principles of climatic classification. Special analysis of certain climatic types. (Lemons.)

Geog. 261. *Applied Climatology.* (3)

Second semester. Prerequisite, Geog. 41, or consent of instructor. Study of principles, techniques, and data of micro-climatology, physical and regional climatology relating to such problems and fields as transportation, agriculture, industry, urban planning, human comfort, and regional geographic analysis. (Lemons.)

Geog. 262, 263. *Seminar in Meteorology and Climatology.* (3, 3)

First and second semesters. Prerequisite, consent of instructor. Selected topics in meteorology and climatology chosen to fit the individual needs of advanced students. (Lemons.)

Geog. 280. *Geomorphology.* (3)

Second semester. An advanced comparative study of selected geomorphic processes and land forms; theories of land forms evolution and geomorphological problems.

(Van Royen.)

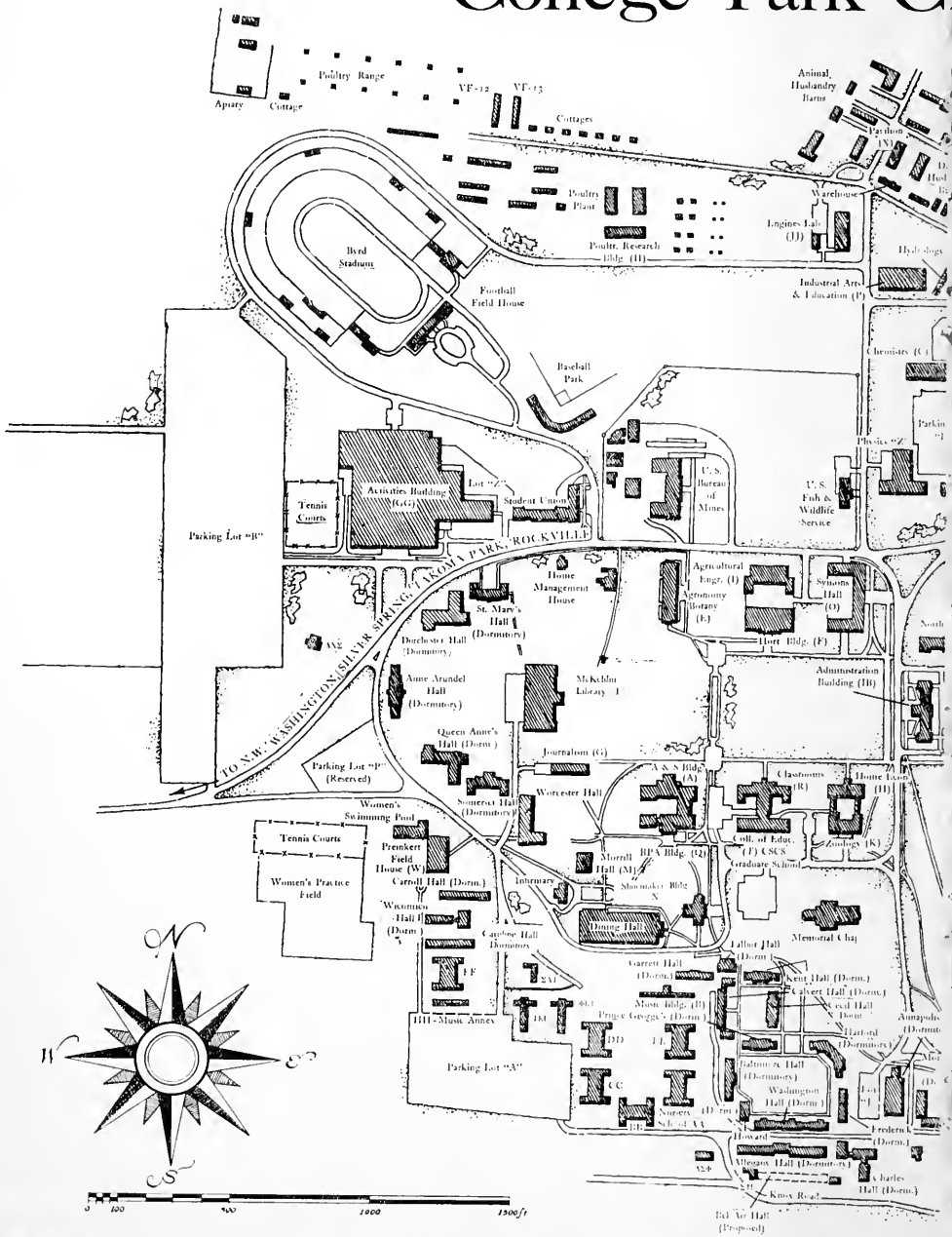
Geog. 290, 291. *Selected Topics in Geography.* (1-3)

First and second semesters. Prerequisite, joint consent of advisor and Head of the Department of Geography. Readings and discussion on selected topics in the field of geography. (Staff.)

Geog. 399. *Thesis Research.*

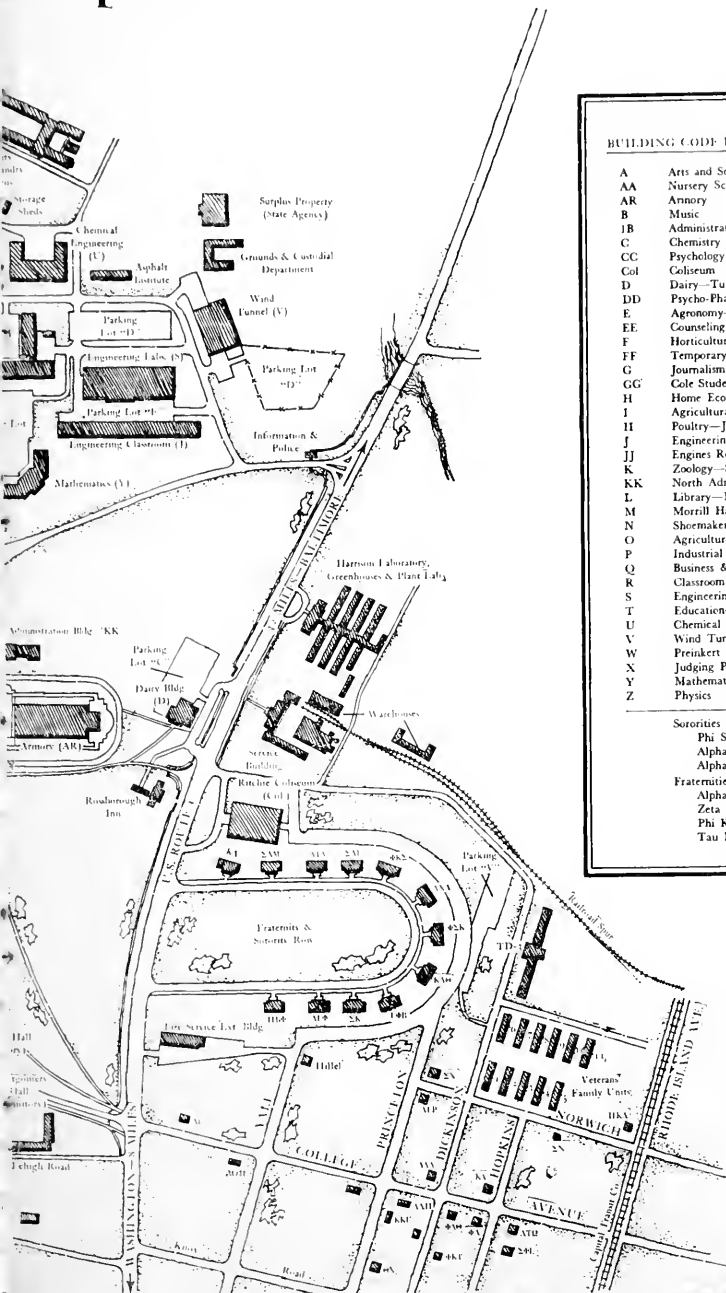
(Credit to be arranged.) First and second semesters; summer session.

UNIVERSITY OF
College Park C



MARYLAND

Campus



BUILDING CODE LETTERS FOR CLASS SCHEDULES

A	Arts and Sciences—Francis Scott Key Hall
AA	Nursery School
AR	Armory
B	Music
IB	Administration
C	Chemistry
CC	Psychology
Col	Coliseum
D	Dairy—Turner Laboratory
DD	Psycho-Pharmacology Laboratory
E	Agronomy—Botany—H. J. Patterson Hall
EE	Counseling Center
F	Horticulture—Holzapfel Hall
FF	Temporary Classroom
G	Journalism
GG	Cole Student Activities Building
H	Home Economics
I	Agricultural Engineering—Shriver Laboratory
II	Poultry—Juli Hall
J	Engineering Classroom Building
JJ	Engines Research Laboratory (Molecular Physics)
K	Zoology—Silverstein Hall
KK	North Administration Building
L	Library—McKeldin Hall
M	Morrill Hall
N	Shoemaker Building
O	Agriculture—Symons Hall
P	Industrial Arts and Education—J. M. Patterson Bldg.
Q	Business & Public Administration—Taliaferro Hall
R	Classroom Building—Woods Hall
S	Engineering Laboratories
T	Education—Skinner Building
U	Chemical Engineering
V	Wind Tunnel
W	Prentiss Field House
X	Judging Pavilion
Y	Mathematics
Z	Physics

Sororities Not Shown

Phi Sigma Sigma
Alpha Chi Omega
Alpha Xi Delta

Fraternities Not Shown

Alpha Epsilon Pi
Zeta Beta Tau
Phi Kappa Gamma
Tau Epsilon Phi

GOVERNMENT AND POLITICS

Professors: PLISCHKE, BURDETTE, STEINMEYER AND WENGERT.

Associate Professors: ANDERSON AND HARRISON.

Assistant Professors: ALFORD AND HATHORN.

The Department of Government and Politics offers a graduate course of study leading to the degree of Master of Arts and the degree of Doctor of Philosophy. For the master's degree, the student may either pursue a general program in Government and Politics, or he may specialize in international affairs or in public administration.

For the master's degree, a comprehensive written examination is given on graduate course work in the major field. At the discretion of the Department, an oral examination may be substituted for the written examination.

The doctoral candidate must show in written examinations satisfactory competence in five of the following fields: (1) Comparative Government; (2) International Political Affairs; (3) Local Government; (4) Political Theory; (5) Public Administration; (6) Public Law; (7) Public Policy. No candidate may attempt the comprehensive examinations prior to completion of the language requirements for the doctorate, and no candidate may attempt the comprehensive examinations more than twice.

Additional information respecting requirements and procedures may be obtained from the Department.

For Graduates and Advanced Undergraduates

G. & P. 101. International Political Relations. (3)

First semester. Prerequisite, G. & P. 1. A study of the major factors underlying international relations, the influence of geography, climate, nationalism, and imperialism, and the development of foreign policies of the major powers. (Harrison.)

G. & P. 102. International Law. (3)

Second semester. Prerequisite, G. & P. 1. Fundamental principles governing the relation of states, including matters of jurisdiction over landed territory, water, airspace, and persons; treatment of aliens; treaty-making; diplomacy; and the laws of war and neutrality. (Harrison.)

G. & P. 104. Inter-American Relations. (3)

Prerequisite, G. & P. 1. An analytical and historical study of the Latin-American policies of the United States and of problems in our relations with individual countries, with emphasis on recent developments. (Harrison.)

G. & P. 105. Recent Far Eastern Politics. (3)

First semester. Prerequisite, G. & P. 1. The background and interpretation of recent political events in the Far East and their influence on world politics. (Steinmeyer.)

G. & P. 106. American Foreign Relations. (3)

First semester. Prerequisite, G. & P. 1. The principles and machinery of the conduct of American foreign relations, with emphasis on the Department of State and the Foreign Service, and an analysis of the major foreign policies of the United States. (Plischke.)

G. & P. 108. International Organization. (3)

Second semester. Prerequisite, G. & P. 1. A study of the objectives, structure, functions, and procedures of international organizations, including the United Nations and such functional and regional organizations as the Organization of American States. (Plischke.)

G. & P. 110. Principles of Public Administration. (3)

First semester. Prerequisite, G. & P. 1. A study of public administration in the United States, giving special attention to the principles of organization and management and to fiscal, personnel, planning, and public relations practices. (Wengert.)

G. & P. 111. Public Personnel Administration. (3)

First semester. Prerequisite, G. & P. 110 or B. A. 160. A survey of public personnel administration, including the development of merit civil service, the personnel agency, classification, recruitment, examination techniques, promotion, service ratings, training, discipline, employee relations, and retirement. (Wengert, Alford.)

G. & P. 112. Public Financial Administration. (3)

Second semester. Prerequisite, G. & P. 110 or Econ. 142. A survey of governmental financial procedures, including processes of current and capital budgeting, the administration of public borrowing, the techniques of public purchasing, and the machinery of control through pre-audit and post-audit. (Wengert, Alford.)

G. & P. 124. Legislatures and Legislation. (3)

Second semester. Prerequisite, G. & P. 1. A comprehensive study of legislative organization, procedure, and problems. The course includes opportunities for student contact with Congress and with the Legislature of Maryland. (Burdette, Hathorn.)

G. & P. 131, 132. Constitutional Law. (3, 3)

First and second semesters. Prerequisite, G. & P. 1. A systematic inquiry into the general principles of the American constitutional system, with special reference to the role of the judiciary in the interpretation and enforcement of the federal constitution; the position of the states in the federal system; state and federal powers over commerce; due process of law and other civil rights. (Hathorn.)

G. & P. 133. Administration of Justice. (3)

Second semester. Prerequisite, G. & P. 1. An examination of civil and criminal court structure and procedures in the United States at all levels of government, with special emphasis upon the federal judiciary. (Staff.)

G. & P. 141. History of Political Theory. (3)

First semester. Prerequisite, G. & P. 1. A survey of the principal political theories set forth in the works of writers from Plato to Bentham. (Anderson.)

G. & P. 142. Recent Political Theory. (3)

Second semester. Prerequisite, G. & P. 1. A study of 19th and 20th century political thought, with special emphasis on recent theories of socialism, communism, and fascism. (Anderson.)

G. & P. 144. American Political Theory. (3)

First semester. Prerequisite, G. & P. 1. A study of the development and growth of American political concepts from the colonial period to the present. (Anderson.)

G. & P. 154. Problems of World Politics. (3)

Second semester. Prerequisite, G. & P. 1. A study of governmental problems of international scope, such as causes of war, problems of neutrality, and propaganda. Students are required to report on readings from current literature. (Steinmeyer.)

G. & P. 174. Political Parties. (3)

First semester. Prerequisite, G. & P. 1. A descriptive and analytical examination of American political parties, nominations, elections, and political leadership. (Burdette, Hathorn.)

G. & P. 178. Public Opinion. (3)

First semester. Prerequisite, G. & P. 1. An examination of public opinion and its effect on political action, with emphasis on opinion formation and measurement, propaganda, and pressure groups. (Burdette, Hathorn.)

G. & P. 181. Administrative Law. (3)

Second semester. Prerequisite, G. & P. 1. A study of the discretion exercised by administrative agencies, including analysis of their functions, their powers over persons and property, their procedures, and judicial sanctions and controls. (Wengert.)

G. & P. 197. Comparative Governmental Institutions. (3)

Second semester. Prerequisite, G. & P. 1. A study of major political institutions, such as legislatures, executives, courts, administrative systems, and political parties, in selected foreign governments. (Harrison.)

For Graduates

G. & P. 201. Seminar in International Political Organization. (3)

A study of the forms and functions of various international organizations. (Plischke.)

G. & P. 202. Seminar in International Law. (3)

Reports on selected topics assigned for individual study and reading in substantive and procedural international law. (Plischke, Harrison.)

G. & P. 205. Seminar in American Political Institutions. (3)

Reports on topics assigned for individual study and reading in the background and development of American government. (Burdette, Hathorn.)

G. & P. 206. Seminar in American Foreign Relations. (3)

Reports on selected topics assigned for individual study and reading in American foreign policy and the conduct of American foreign relations. (Plischke.)

G. & P. 207. *Seminar in Comparative Governmental Institutions.* (3)

Reports on selected topics assigned for individual study and reading in governmental and political institutions in governments throughout the world. (Steinmeyer, Harrison.)

G. & P. 211. *Seminar in Federal-State Relations.* (3)

Reports on topics assigned for individual study and reading in the field of recent federal-state relations. (Wengert.)

G. & P. 213. *Problems of Public Administration.* (3)

Reports on topics assigned for individual study and reading in the field of public administration. (Wengert.)

G. & P. 214. *Problems of Public Personnel Administration.* (3)

Reports on topics assigned for individual study and reading in the field of public personnel administration. (Wengert.)

G. & P. 215. *Problems of State and Local Government in Maryland.* (3)

Reports on topics assigned for individual study in the field of Maryland state and local government. (Staff.)

G. & P. 216. *Government Administrative Planning and Management.* (3)

Reports on topics assigned for individual study and reading in administrative planning and management in government. (Staff.)

G. & P. 217. *Government Corporations and Special Purpose Authorities.* (3)

Reports on topics assigned for individual study and reading in the use of the corporate form for governmental administration. The topics for study will relate to the use of the corporate form as an administrative technique, as in the cases of the Tennessee Valley Authority, the Port of New York Authority, and local housing authorities. (Staff.)

G. & P. 221. *Seminar in Public Opinion.* (3)

Reports on topics assigned for individual study and reading in the field of public opinion. (Burdette.)

G. & P. 223. *Seminar in Legislatures and Legislation.* (3)

Reports on topics assigned for individual study and reading about the composition and organization of legislatures and about the legislative process. (Burdette.)

G. & P. 224. *Seminar in Political Parties and Politics.* (3)

Reports on topics assigned for individual study and reading in the fields of political organization and action. (Burdette, Hathorn.)

G. & P. 225. *Man and the State.* (3)

Individual reading and reports on such recurring concepts in political theory as liberty, equality, justice, natural law and natural rights, private property, sovereignty, nationalism, and the organic state. (Anderson.)

G. & P. 231. *Seminar in Public Law.* (3)

Reports on topics assigned for individual study and reading in the fields of constitutional and administrative law. (Staff.)

G. & P. 251. *Bibliography of Government and Politics.* (3)

Survey of the literature of the various fields of government and politics and instruction in the use of government documents. (Staff.)

G. & P. 261. *Problems of Government and Politics.* (3)

Credit according to work accomplished. (Staff.)

G. & P. 281. *Department Seminar.* (No Credit)

Topics as selected by the graduate staff of the Department. Registration for two semesters required of all doctoral candidates. Conducted by the entire departmental staff in full meeting. (Staff.)

G. & P. 399. *Thesis Research.* (Arranged)

(Staff.)

HISTORY

Professors: LAND, CHATELAIN, MERRILL AND PRANGE.

Associate Professors: BAUER, GORDON, JASHEMSKI, SPARKS AND STROMBERG.

Assistant Professors: BEARD, RIDDLEBERGER, FERGUSON AND RIVLIN.

Instructor: PARMER.

Master of Arts

1. Eight to ten hours of the total major course requirements of all candidates for this degree must be acquired in general field of the thesis, i.e., either American or European history.

2. H. 287, Historiography, is required of all candidates for graduate degrees in history.

3. Candidates for the Master of Arts degree must pass a three-hour qualifying written examination. This examination is normally taken shortly before the final oral examination. The purpose of the written examination is to determine the student's grasp of the larger field in which the thesis lies, (e. g. American, European, English, Latin-American history). The examination will include not only factual and interpretative material, but also bibliography and historiography. However, it will not be based on courses as such.

4. The final oral examination will be confined to the general field of the thesis, and the thesis itself. It is understood that the representative of the minor field may examine the candidate on the minor subject or subjects at his discretion.

5. The thesis must be submitted in final form to the candidate's committee three weeks prior to the final oral examination.

Doctor of Philosophy

1. At least thirty hours of the total major course requirements, including H. 287, must be acquired in the general field of the thesis, i.e., American history or European history.

2. At least ten hours of the thirty required for a minor in history must be taken at the University of Maryland.

3. Recommendations for admission to candidacy will be determined by the Department on the basis of achievement which the student is required to substantiate by oral or written examinations.

4. Before confirmation for the degree the student must pass the final oral examination required by the Graduate School.

5. The thesis must be submitted in final form to the candidate's committee five weeks prior to the final oral examination.

A. AMERICAN HISTORY

For Graduates and Advanced Undergraduates

H. 5, 6 are prerequisites for courses H. 101 to H. 142, inclusive.

H. 101. American Colonial History. (3)

First semester; summer session (2). The settlement and development of colonial America to the middle of the eighteenth century. (Ferguson.)

H. 102. The American Revolution. (3)

Second semester; summer session (2). The background and course of the American Revolution through the formation of the Constitution. (Ferguson.)

H. 105. Social and Economic History of the United States to 1865. (3)

First semester; summer session (2). A synthesis of American life from independence through the Civil War. (Chatelain.)

H. 106. Social and Economic History of the United States Since the Civil War. (3)

Second semester; summer session (2). The development of American life and institutions, with emphasis upon the period since 1876. (Chatelain.)

H. 114. The Middle Period of American History 1824-1860. (3)

First semester; summer session (2). An examination of the political history of the United States from Jefferson to Lincoln with particular emphasis on the factors producing Jacksonian democracy, Manifest Destiny, the Whig Party, the anti-slavery movement, the Republican Party, and secession. (Sparks.)

H. 115. The Old South. (3)

First semester; summer session (2). A study of the institutional and cultural life of the ante-bellum South with particular reference to the background of the Civil War. (Riddleberger.)

H. 116. The Civil War. (3)

Second semester; summer session (2). Military aspects; problems of the Confederacy; political, social, and economic effects of the war upon American society. (Sparks.)

H. 117. The New South. (3)

First semester; summer session (2). The South's place in the Nation from Appomattox to the present with special reference to regional problems and aspirations.

(Riddleberger.)

H. 118, 119. Recent American History. (3, 3)

Summer session (2, 2). Party politics, domestic issues, foreign relations of the United States since 1890. First semester, through World War I. Second semester, since World War I.

(Merrill.)

H. 121. History of the American Frontier. (3)

First semester; summer session (2). Prerequisites, H. 5, 6, or the equivalent. The Trans-Allegheny West. The westward movement into the Mississippi Valley. (Staff.)

H. 122. History of the American Frontier. (3)

Second semester; summer session (2). Prerequisites, H. 5, 6, or the equivalent. The Trans-Mississippi West. Forces and factors in the settlement and development of the Trans-Mississippi West to about 1900.

(Staff.)

H. 123. The New West. (3)

Second semester; summer session (2). Regional peculiarities and national significance of the Plains and Pacific Coast areas from 1890 to the present.

(Bates.)

H. 124. Reconstruction and the New Nation 1865-1896. (3)

First semester; summer session (2). Problems of reconstruction in both South and North. Emergence of big business and industrial combinations. Problems of the farmer and laborer.

(Merrill.)

H. 127, 128. Diplomatic History of the United States. (3, 3)

First and second semesters. An historical study of the diplomatic negotiations and foreign relations of the United States. First semester, from the Revolution to the Civil War; second semester, from the Civil War to the present.

(Wellborn.)

H. 129. The United States and World Affairs. (3)

First semester; summer session (2). A consideration of the changed position of the United States with reference to the rest of the world since 1917.

(Wellborn, Hanks.)

H. 133, 134. The History of Ideas in America. (3, 3)

First and second semesters; summer session (2, 2). An intellectual history of the American people, embracing such topics as liberty, democracy, and social ideas.

(Beard.)

H. 135, 136. Constitutional History of the United States. (3, 3)

First and second semesters. A study of the historical forces resulting in the formation of the Constitution, and the development of American constitutionalism in theory and practice thereafter.

(Land.)

H. 141, 142. History of Maryland. (3, 3)

First and second semesters; summer session (2, 2). Three hours a week. First semester, a survey of the political, social and economic history of colonial Maryland. Second semester, Maryland's historical development and role as a state in the American Union.

(Chatelain.)

History

H. 145, 146. *Latin-American History.* (3, 3)

First and second semesters; summer session (2). Three hours a week. A survey of the history of Latin America from colonial origins to the present, covering political, cultural economic, and social development, with special emphasis upon relations with the United States. First semester, the colonial Period. Second semester, The Republics. (Crosman.)

H. 147. *History of Mexico.* (3)

First semester. The history of Mexico with special emphasis upon the independence period and upon relations between ourselves and the nearest of our Latin American neighbors. (Crosman.)

B. EUROPEAN HISTORY

H. 1, 2 or H. 53, 54 are prerequisites for courses H. 151 to H. 191, inclusive.

H. 151. *History of the Ancient Orient and Greece.* (3)

First semester. A survey of the ancient empires of Egypt, the Near East, and Greece, with particular attention to their institutions, life, and culture. (Jashemski.)

H. 153. *History of Rome.* (3)

Second semester. A study of Roman civilization from the earliest beginnings through the Republic and down to the last centuries of the Empire. (Jashemski.)

H. 155. *Medieval Civilization.* (3)

First semester; summer session (2). A survey of Medieval life, culture, and institutions from the fall of the Roman Empire to the thirteenth century. (Jashemski.)

H. 161. *The Renaissance and Reformation.* (3)

Second semester; summer session (2). The culture of the Renaissance, the Protestant revolt and Catholic reaction through the Thirty Years War. (Jashemski.)

H. 163, 164. *The Middle East.* (3, 3)

First and second semesters. A survey of the historical and institutional developments of the nations of this vital area. The Islamic Empires and their cultures; impact of the west; breakup of the Ottoman Empire and rise of nationalism; present day problems. (Rivlin.)

H. 165. *Topics from Middle Eastern History in the Nineteenth and Twentieth Centuries.* (3)

First semester. Prerequisites, H. 163, 164 or the equivalent or permission of the instructor. Conference Course for advanced undergraduate and graduate students. Lectures and special assignments, dealing with Middle Eastern institutions in the nineteenth and twentieth centuries. (Rivlin.)

H. 166. *The French Revolution.* (2)

First semester; summer session (2). The Enlightenment and the Old Regime in France; the revolutionary uprisings from 1789 to 1799. (Gordon.)

H. 167. *Napoleonic Europe.* (2)

Second semester; summer session (2). European developments from the rise of Napoleon to the Congress of Vienna. (Gordon.)

H. 171, 172. Europe in the Nineteenth Century, 1815-1919. (3, 3)

First and second semesters; summer session (2, 2). A study of the political, economic, social, and cultural development of Europe from the Congress of Vienna to the First World War. (Bauer.)

H. 175, 176. Europe in the World Setting of the Twentieth Century. (3, 3)

First and second semesters. A study of political, economic, and cultural developments in twentieth century Europe with special emphasis on the factors involved in the two World Wars and their global impacts and significance. (Prange.)

H. 185, 186. History of the British Empire. (3, 3)

First and second semesters. H. 186, summer session (2). First semester, the development of England's Mercantilist Empire and its fall in the war for American Independence (1783); second semester, the rise of the Second British Empire and the solution of the problem of responsible self-government (1783-1867), the evolution of the British Empire into a Commonwealth of Nations, and the development and problems of the dependent Empire. (Gordon.)

H. 187. History of Canada. (3)

First semester; summer session (2). A history of Canada, with special emphasis on the nineteenth century and upon Canadian relations with Great Britain and the United States. (Gordon.)

H. 189. Constitutional History of Great Britain. (3)

Second semester. A survey of constitutional development in England with emphasis on the real property aspects of feudalism, the growth of the common law, the development of Parliament, and the expansion of liberties of the individual. (Gordon.)

H. 191. History of Russia. (3)

First semester. A history of Russia from the earliest times to the present day. (Bauer.)

H. 192. Foreign Policy of the USSR. (3)

Second semester; summer session (2). Prerequisites, H. 1, 2 and H. 191. A survey of Russian foreign policy in the historical perspective, with special emphasis on the period of the USSR. Russian aims, expansion, and conflicts with the western powers of Europe, the Near and Middle East, and the Far East will be studied. (Bauer.)

H. 193, 194. History of European Ideas in Modern Times. (3, 3)

First and second semesters. Beginning with a review of the basic Western intellectual traditions as a heritage from the Ancient World, the course will present selected important currents of thought from the scientific revolution of the 16th and 17th centuries down to the 20th century. First semester through the 18th century. Second semester, 19th and 20th centuries. (Stromberg.)

H. 195. The Far East. (3)

First semester; summer session (2). A survey of institutional, cultural and political aspects of the history of China and Japan and a consideration of present-day problems of the Pacific area. (Farmer.)

History

H. 196. *Southeast Asia*. (3)

Second semester; summer session (2). The political, economic and cultural history of the new nations of Southeast Asia with emphasis on the colonial period and a view to understanding contemporary developments. (Parmer.)

H. 199. *Proseminar in Historical Writing*. (3)

First and second semesters. (Bauer, Riddleberger.)

For Graduates

H. 201. *Seminar in American History*. (3)

First and second semesters; summer session (2). (Staff.)

H. 202. *Historical Literature*. (3)

First and second semesters; summer session (2). Assignments in various selected fields of historical literature and bibliography to meet the requirements of qualified graduate students who need more intensive concentration. (Staff.)

H. 203, 204. *Seminar in the History of Maryland*. (3, 3)

First and second semesters. (Land.)

H. 205, 206. *Topics in American Economic and Social History*. (3, 3)

First and second semesters. Readings and conferences on the critical and source materials explaining our social and economic evolution. (Chatelain.)

H. 208. *Seminar in Recent American History*. (3)

First and second semesters. (Merrill.)

H. 211. *The Colonial Period in American History*. (3)

First semester. Readings and conferences designed to familiarize the student with some of the sources and the classical literature of American Colonial History. (Ferguson.)

H. 212. *Period of the American Revolution*. (3)

Second semester. Readings and conferences designed to familiarize the student with some of the critical literature and sources of the period of the American Revolution. (Ferguson.)

H. 214. *Seminar in the Middle Period of American History*. (3)

A seminar in the sources and problems of American political and military history from the Jackson Era to the election of Lincoln. (Sparks.)

H. 215. *The Old South*. (3)

First semester. Readings and conferences designed to familiarize the student with some of the standard sources and the classical literature of the ante-bellum South. (Riddleberger.)

H. 216. *Seminar in The American Civil War*. (3)

First semester. A seminar in the sources and problems of the history of the American Civil War. Military and political problems are emphasized. (Sparks.)

H. 217. *Reconstruction and its Aftermath.* (3)

Second semester. A seminar on problems resulting from the Civil War. Political, social and economic reconstruction in South and North; projection of certain post-war attitudes and problems into the present. (Merrill.)

H. 221, 222. *History of the West.* (3, 3)

Summer session (2, 2). Readings and conferences designed to give the student an acquaintance with some of the more important sources and some of the most significant literature of the advancing American frontier. (Staff.)

H. 233, 234. *Topics in American Intellectual History.* (3, 3)

Readings and conferences on selected phases of American thought, with emphasis on religious traditions, social and political theory, and development of American ideas. (Beard.)

H. 245. *Topics in Latin-American History.* (3)

Selected readings, research, and conferences on important topics in Latin American History. (Crosman.)

H. 250. *Seminar in European History.* (3)

First and second semesters; summer session (2). (Bauer.)

H. 251. *Seminar in Greek History.* (3)

Readings and conferences designed to acquaint the students with selected topics and sources in Greek and Hellenistic history. (Jashemski.)

H. 253. *Seminar in Roman History.* (3)

Readings and conferences designed to acquaint the student with selected topics and sources in Roman history. (Jashemski.)

H. 255. *Medieval Culture and Society.* (3)

(Arranged.) Readings and conferences designed to acquaint the student with the important literature and interpretations on such topics as feudalism, the medieval Church, schools and universities, Latin and vernacular literature, art and architecture. (Jashemski, Bauer.)

H. 265. *Problems in Diplomatic History of the Middle East.* (3)

Second semester. Prerequisites, H. 163, 164 or H. 165 or the equivalent. Studies involving the international relations of the Middle East. A knowledge of French and/or another foreign language is required or permission of the instructor. (Rivlin.)

H. 282. *Problems in the History of World War II.* (3)

Investigation of various aspects of the Second World War, including military operations, diplomatic phases, and political and economic problems of the war and its aftermath. (Prange.)

H. 285, 286. *Seminar in the History of Britain and the British Empire.* (3, 3)

First and second semesters. Readings and conferences on the documentary and literary materials dealing with the transformation of England and the growth and evolution of the British Empire since 1763. (Gordon.)

H. 287. Historiography. (3)

First and second semesters. Readings and occasional lectures on the historical writing, the evolution of critical standards, the rise of auxiliary sciences, and the works of selected masters. The work of the course includes field trips to the Library of Congress and the National Archives. Required of all candidates for advanced degrees. (Sparks.)

H. 399. Research. (3-6)

Credit apportioned to amount of research. First and second semesters. (Staff.)

HOME ECONOMICS

Professors: LIPPEATT, KING AND MITCHELL.

Associate Professor: BRAUCHER.

Assistant Professor: WILBUR.

The College offers a course of study leading to the degree of Master of Science in the fields of Food, Nutrition, and Textiles and Clothing.

As preparation for work toward an advanced degree in Food, a student should have completed courses in general and organic chemistry, quantitative analysis and biochemistry, general microbiology, human physiology, nutrition, and advanced and experimental food preparation.

For an advanced degree in Nutrition, a student should have completed all the chemistry required for the degree in Food except quantitative analysis; the biological sciences named above, food preparation, and six hours of nutrition.

Programs of study for the advanced degree in Textiles and Clothing have considerable flexibility. Prerequisites are evaluated in relation to the program the student wishes to pursue. In general they are completion of courses in art, inorganic chemistry, economics, psychology, sociology, textiles and clothing (general textiles, clothing construction, pattern design), and adequate background in home economics for an understanding of basic human needs.

Deficiencies in any of the above fields may be made up by taking the recommended undergraduate courses without graduate credit.

A. FOODS AND NUTRITION

For Graduates and Advanced Undergraduates

Foods 100. Food Economics. (2)

First semester. Prerequisite, Foods 1 or 2, 3. One lecture and one laboratory period a week. Laboratory fee, \$7.00. Sources of our food supply; buying of food for the family. (Cornell.)

Foods 101. Meal Management. (2)

First and second semesters. Two laboratory periods a week. Prerequisite, Foods 1, or 2, 3. Laboratory fee, \$10.00. Planning, preparing and serving meals for family groups, considering nutritional needs and management of money, time and labor; includes entertaining. (Cornell, Hammel.)

Foods 102. Experimental Foods. (3)

First semester. One lecture and two laboratory periods a week. Prerequisite, Foods 2, 3; Organic Chemistry, Chem. 31, 32, 33, 34. Laboratory fee, \$10.00. A study of food preparation processes from the experimental viewpoint. (King.)

Foods 104. Advanced Foods. (2-3)

First semester. Prerequisite, Foods 2, 3; Chem. 31, 32, 33, 34. Laboratory fee, \$3.00. The physical and chemical behavior of the basic food constituents in food preparation and processing; study of recent advances in those fields. (King.)

Foods 105. Foods of Other Countries. (3)

Second semester. One lecture and two laboratory periods a week. Prerequisite, Foods 1 or 2, 3, or equivalent. Laboratory fee, \$10.00. Food preparation and food customs of the peoples of other countries. (Cornell.)

Nut. 110. Nutrition. (3)

First and second semesters. Prerequisite, Foods 2, 3; Organic Chemistry, Chem. 31, 32, 33, 34 to precede or parallel. Laboratory fee, \$10.00. A scientific study of principles of human nutrition. Animal experimentation. Correction of nutritional deficiencies by dietary studies. (Braucher.)

Nut. 111. Child Nutrition. (2)

First and second semesters. One lecture and one laboratory period a week. Prerequisite, Foods 1 or 2, 3, Nut. 10 or 110. Laboratory fee, \$7.00. Principles of human nutrition applied to growth and development of children. Experience in a nursery school. (Collins.)

Nut. 112. Dietetics. (3)

Second semester. One lecture and two laboratory periods a week. Prerequisite, Nut. 110. Laboratory fee, \$10.00. A study of food selection for health; planning and calculating dietaries for children, adults and family units; methods of teaching food values and nutrition. (Pelcovits.)

Nut. 113. Diet and Disease. (2)

Second semester. Alternate years. Prerequisite, Nut. 110. Laboratory fee, \$3.00. Modifications of the normal adequate diet to meet the nutritional needs in treating certain diseases. (Staff.)

Nut. 114. Nutrition for Health Services. (3)

Second semester. Prerequisite, Nut. 10 or the equivalent. Laboratory fee, \$3.00. A scientific study of nutritional status and the effect of food habits and food consumption on family health. Nutritional requirements for individuals in different stages of development. Techniques and procedures for the application of nutrition knowledge with consideration of various economic levels and social backgrounds. For graduate nurses, dietitians, health teachers, and social workers. (Braucher.)

Nut. 120. Advanced Nutrition. (3)

First semester. Prerequisites, Foods 3; Zool. 1; Biochemistry 81, 82 or concurrent. Laboratory fee, \$3.00. The progress of nutrition as found in the results of current research, with emphasis on interpretation and application. (Sidwell.)

For Graduates

Foods 200. Advanced Experimental Foods. (3-5)

Second semester. Two lectures and three laboratory periods a week. Laboratory fee, \$10.00. Selected readings of literature in experimental foods. Development of individual problem. (King.)

Foods 204. Recent Trends in Foods. (2-3)

First semester. Laboratory fee, \$3.00. Recent trends in the preparation, processing and marketing of foods. (King.)

Foods 210. Readings in Foods. (3)

Second semester. Prerequisite, Foods 102, 104. A critical survey of literature on recent developments in food research. (King.)

Foods 220. Seminar. (1, 1)

First semester. Reports and discussions of current research in foods. (Staff.)

Foods 399. Research. (6)

First and second semesters. Laboratory fee, \$10.00. Credit in proportion to work done and results accomplished. Investigation in some phases of food which may form the basis of a thesis. (Staff.)

Nut. 204. Recent Advances in Nutrition. (2-3)

Second semester. Laboratory fee, \$3.00. Factors that affect the nutritive value of food during production, cookery processes, holding practices, processing, packaging and storage. (Braucher.)

Nut. 208. Recent Progress in Human Nutrition. (3)

Second semester. Laboratory fee, \$3.00. The recent developments in the science of nutrition with emphasis upon the interpretations of these findings for application in health and disease. Aids for the dietitian in creating a better understanding of nutrition among patients, students of graduate status and personnel, such as those of the dental and medical profession. (Braucher.)

Nut. 210. Readings in Nutrition. (3)

First semester. Laboratory fee, \$3.00. Reports and discussion of outstanding nutritional research and investigation. (Braucher.)

Nut. 211. Problems in Nutrition. (3-5)

Second semester. Laboratory fee, \$10.00. Experience in a phase of nutrition research which is of interest to the student. Use of experimental animals, human studies or an extensive and critical survey of the literature. (Braucher.)

Nut. 212. Nutrition for Community Service. (3)

First semester. Laboratory fee, \$3.00. Applications of the principles of nutrition to various community problems. Students may work on problems of their own choosing. (Braucher.)

Nut. 220. Seminar. (1, 1)

First and second semesters. Reports and discussions of current research in nutrition. (Staff.)

Nut. 399. Research. (6)

First and second semesters. Laboratory fee, \$10.00. Credit in proportion to work done and results accomplished. Investigation in some phase of nutrition which may form the basis of a thesis. (Braucher.)

B. HOME MANAGEMENT

*For Graduates and Advanced Undergraduates**Home Mgt. 150, 151. Management of the Home. (3, 3)*

Two lectures and one laboratory period a week. Prerequisite, Econ. 37. Laboratory fee for Home Mgt. 151, \$3.00. Principles of scientific management applied to the family's use of resources, particularly to use of time, energy and money, pointing up the importance of choice as values and goals change throughout the life cycle. Housing from the sociological aspects of what constitutes good housing, housing legislation, determination of a family's housing needs, ways and means of meeting them. Household equipment, its selection, use and care, as durable and non-durable goods of the family. (Crow, Staff.)

Home Mgt. 152. Experience in Management of the Home. (3)

First and second semesters. Prerequisites, Home Mgt. 150, 151. Laboratory fee, \$10.00. Residence for one third of a semester in the Home Management House. Experience in planning, coordinating and participating in the activities of a household composed of a faculty member and a group of students. (Crow, Staff.)

Home Mgt. 155. Money Management. (2)

(Not offered 1959-60.) Two lectures a week. Prerequisite, Home Mgt. 150 or consent of instructor. Integrating the use of money and other available resources to meet both individual and family wants and needs. Emphasis on areas of finance influencing family economic decisions. (Crow.)

Home Mgt. 156. Household Equipment. (2)

(Not offered 1959-60.) Two laboratory periods a week. Laboratory fee, \$3.00. Problems in selection, use and care of small and large equipment. (Staff.)

Home Mgt. 158. Special Problems in Management. (3)

Summer session only. Five lectures; one two-hour laboratory. Prerequisites, Home Mgt. 150, 151 or equivalent. Laboratory fee, \$3.00. Analysis of some of the important management problems in the home and in the home economics classroom. Financial problems, problems in work simplification, problems related to housing and household equipment. (Crow.)

Inst. Mgt. 160. Institution Organization and Management. (3)

First semester. Prerequisites, Foods 2, 3; Nut. 110, Home Mgt. 150, 151 to precede or parallel. Vocational opportunities in the field of institution management; organization of food service departments. Planning of functional kitchens and selection of equipment for quantity food services. Field trips required. (Collins.)

Inst. Mgt. 161. Institution Food Purchasing and Cost Control. (3)

Second semester. Prerequisite, Foods 2, 3; Nut. 10 or 110 or equivalent. Selection of food, method and units of purchase in large quantities. Budgets, food cost accounting and control. Field trips required. (Collins.)

Inst. Mgt. 162. Institution Foods. (3)

Second semester. One lecture and two laboratory periods a week. Prerequisite, Foods 2, 3; Nut. 10 or 110 or consent of instructor. Laboratory fee, \$10.00. Application of basic principles and procedures of food preparation to quantity food preparation. Standardizing recipes; menu planning for various types of food services; determination of food costs. Field trips required. (Collins, Pelcovits.)

Inst. Mgt. 164. Food Service Administration and Personnel Management. (2)

Second semester. One lecture and one laboratory period a week. Prerequisites, Inst. Mgt. 160, 161, 162 or the equivalent. Administrative policies, problems, and personnel management. Field trips required. (Staff.)

Inst. Mgt. 165. School Food Service. (3)

Two lectures and one morning a week for practical experience in a school food service. Prerequisites, Foods 1 or 2, 3 and Nut. 10 or 110, or consent of instructor. Not open to institution management majors. Study of organization, management, menu planning, food purchasing and preparation, and cost control for serving the noon meal in schools and child care centers. (Collins.)

Inst. Mgt. S166. Nutrition and Meal Planning. (2)

(Not offered 1959.) Summer session. One lecture and two laboratory periods. Prerequisite, Inst. Mgt. 160 or equivalent. Special application to group food services; school lunches, restaurants, and hospitals. (Staff.)

For Graduates

Inst. Mgt. 200. Advanced Food Service Management and Supervision. (3)

First semester. One lecture and two laboratory periods a week. Prerequisites, Inst. Mgt. 162, 165 or equivalent. Special problems in management and service. Opportunity for the student to work out problems encountered on the job. (Staff.)

C. PRACTICAL ART AND CRAFTS

For Graduates and Advanced Undergraduates

Pr. Art 100, 101. Mural Design. (2, 2)

First semester, alternate years. Three laboratory periods a week. Prerequisites, Pr. Art 1, 21. Fee, \$3.00. Group and individual expression serving two types of objectives: temporary murals for the public schools developed from classroom study and rendered in colored chalk on wrapping paper; murals for permanent architectural decoration considering propriety to setting and rendered in oil paint, gouache, fresco, or mosaic. Brief study of civilization's use of murals. Trips to nearby murals having social significance. (Curtiss.)

Pr. Art 120, 121. Costume Illustration. (2, 2)

First and second semesters. Two laboratory periods a week. Prerequisites, Pr. Art 1, 2, 20, 21. Fee, \$3.00. Fashion rendering emphasizing clothing structure, representation of materials and development of individual rendering technique. Development of techniques employing transparent water color, India ink, Craftint, Zipatone and Burgess process. Study of styles of contemporary fashion illustrators. (Elliott.)

Pr. Art 124, 125. Individual Problems in Costume. (2, 2)

First and second semesters. Two laboratory periods a week. Prerequisites, Pr. Art 1, 2, 20, 21, 120, 121. Fee, \$3.00. Advanced problems in fashion illustration or costume design for students who are capable of independent work. Program developed in consultation with the instructor. (Elliott.)

Pr. Art 132. Advertising Layout. (2)

First and second semesters. Two laboratory periods a week. Prerequisites, Pr. Art 1, 20, 30, 40. Fee, \$3.00. Designing of rough to finished layouts for advertisements for newspapers, magazines, packaging, brochures and other forms of direct advertising. Included is the study of typography and illustration and their relationship to reproduction. Experience in use of the airbrush. Field trip. (Cuneo.)

Pr. Art 134, 135. Individual Problems in Advertising. (2, 2)

First and second semesters. Two laboratory periods a week. Prerequisites, Pr. Art 1, 20, 30, 40, 132. Fee, \$3.00. Advanced problems in advertising layout. Opportunity to build skills in one area or more of advertising design. Readings. Field trip. (Cuneo.)

Pr. Art 136. Display. (2)

First and second semesters. Three laboratory periods a week. Prerequisites, Pr. Art 1, 4, 30. Fee, \$3.00. Practice in effective merchandise display in cooperation with retail establishments. Study of other aspects of display through field trips, discussion and research. (Longley.)

Pr. Art 138. Advanced Photography. (2)

First and second semesters. Three laboratory periods a week. Prerequisites, Pr. Art 1, 38, 39. Fee, \$3.00. Advanced experimental effects emphasizing design in photography. Each student must have his own camera. (Davis.)

Pr. Art 142, 143. Advanced Interior Design. (2, 2)

First and second semesters. Two laboratory periods a week. Prerequisites, Pr. Art 1, 2, 40, 41. Fee, \$3.00. Designing of rooms drawn in perspective and isometrics and rendered in water color. Coordination with fabrics, floor and wall finishes. Study of budgets, costs, and manufacturing techniques. Field trips. (Jones.)

Pr. Art 144, 145. Individual Problems in Interior Design. (2, 2)

First and second semesters. Two laboratory periods a week. Prerequisites, Pr. Art 1, 2, 40, 41, 142, 143. Fee, \$3.00. Advanced problems in interior design for students who are capable of independent work. Students assume the role of interior decorator serving the needs of theoretical clients. Field trips. (Jones.)

Cr. 102. Creative Crafts. (2-4)

Summer session. Daily laboratory periods. Prerequisites, Pr. Art 1 and permission of

the instructor. Fee, \$3.00. Interests of the persons enrolled will determine the crafts pursued. Suggested: block printing, wood burning, crayon decoration, paper sculpture, clay modeling, metalry, weaving. Excellent for teachers, directors of recreation centers, and persons who desire an introduction to recreational crafts. (Staff.)

Cr. 120, 121. Advanced Ceramics. (2, 2)

First and second semesters. Three laboratory periods a week. Prerequisites, Pr. Art 1, Cr. 20, 21. Fee, \$3.00. Advanced techniques in clay sculpture and in building pottery on the potter's wheel. Study of glaze composition and calculation. Experimentation with several clay bodies. (Hodgson.)

Cr. 124, 125. Individual Problems in Ceramics. (2, 2)

First and second semesters. Three laboratory periods a week. Prerequisites, Pr. Art 1, Cr. 20, 21, 120, 121. Fee, \$3.00. Individual problems in clay sculpture and pottery making. Use of gas kiln fired in the medium cone range and experimental research in glazes and original textural effects. (Hodgson.)

Cr. 130, 131. Advanced Metalry. (2, 2)

First and second semesters. Three laboratory periods a week. Prerequisites, Pr. Art 1, Cr. 30, 31. Fee, \$3.00. Advanced applications of basic techniques in metal working and jewelry making. Introduction of ring making, stone setting, and metal casting. (Longley.)

Cr. 134, 135. Individual Problems in Metalry. (2, 2)

First and second semesters. Three laboratory periods a week. Prerequisites, Pr. Art 1, Cr. 30, 31, 130, 131. Fee, \$3.00. Advanced problems in metalry and jewelry making. Supervised laboratory for students capable of independent work and research. (Longley.)

Cr. 140, 141. Advanced Weaving. (2, 2)

First and second semesters. Three laboratory periods a week. Prerequisites, Pr. Art 1, Cr. 40, 41. Fee, \$3.00. Advanced weaving on four and eight harness looms stressing creative weaves in relation to functional use. (Hodgson.)

Cr. 144, 145. Individual Problems in Weaving. (2, 2)

First and second semesters. Three laboratory periods a week. Prerequisites, Pr. Art 1, Cr. 40, 41, 141. Fee, \$3.00. Advanced problems in creative weaving. Supervised laboratory for students capable of independent work and research. (Hodgson.)

D. TEXTILES AND CLOTHING

For Graduates and Advanced Undergraduates

Tex. 100. Advanced Textiles. (3)

First semester. One lecture and two laboratory periods a week. Prerequisite, Tex. 1. Laboratory fee, \$3.00. The intensive study of textiles from the fiber to the finished fabric, from the producer to the consumer. Analysis of fabric construction and serviceability features. (Staff.)

Tex. 101. Problems in Textiles. (3)

Second semester. One lecture and two laboratory periods a week. Prerequisites, Tex. 100, organic chemistry. Laboratory fee, \$3.00. Individual experimental problems in textiles. (Staff.)

Tex. 102. Textile Testing. (3)

Second semester. Three laboratory periods a week. Prerequisite, Tex. 100. Laboratory fee, \$3.00. The theory of textile testing methods, the repeated use of physical and chemical testing, the interpretation of the data, and the presentation of the findings. (Staff.)

Tex. 105. Consumer Problems in Textiles. (3)

First and second semesters. Three lectures a week. Prerequisite, Tex. 1, or equivalent. Laboratory fee, \$3.00. Study of textiles from the consumer point of view for personal, household and institutional use. Evaluation of such textiles through analysis of comparison shopping, laboratory tests, survey of literature and field trips. (Staff.)

Tex. 108. Decorative Fabrics. (2)

First semester. Two lectures a week. Laboratory fee, \$3.00. Study of historic and contemporary fabrics and laces with analysis of designs and techniques of decorating fabrics. (Wilbur.)

Clo. 120. Draping. (3)

First semester. Three laboratory periods a week. Prerequisites, Clo. 21, Clo. 122. Laboratory fee, \$3.00. Demonstrations and practice in creating costumes in fabrics on individual dress forms; modeling of garments for class criticism. (Wilbur.)

Clo. 122. Tailoring. (2)

First and second semesters. Two laboratory periods a week. Prerequisite, Clo. 21. Laboratory fee, \$3.00. Construction of tailored garments, requiring professional skill. (Mitchell, Heagney, Parker.)

Clo. 123. Children's Clothing. (2)

First semester. Two laboratory periods a week. Prerequisite, Clo. 20, or equivalent. Laboratory fee, \$3.00. Children's clothing from the standpoint of age, health, beauty, economy and personality; development of original designs. (Heagney, Wilbur.)

Clo. 124. Projects and Readings in Textiles and Clothing. (2)

First semester. Two lectures a week. Prerequisites, Clo. 120, Tex. 100. Laboratory fee, \$3.00. Analysis of wardrobe planning preparatory to the job situation; grooming as related to the college girl and to the job holder; survey of job opportunities in the field; special projects. (Mitchell.)

Clo. 125. Costume Draping. (3)

Second semester. Three two-hour laboratory periods a week. Prerequisite, Pr. Art 20 or consent of Department. Laboratory fee, \$3.00. By means of draping in fabrics on a form the development of costumes both historic and contemporary for specific needs, purposes and occasions. Consideration of fabric, line and color are integral part of the work. (Wilbur.)

Horticulture

Clo. 126. Fundamentals of Fashion. (2,3)

Second semester. Prerequisite, Clo. 120. Laboratory fee, \$3.00. Fashion history; current fashions, how to interpret and evaluate them; fashion show techniques; fashion promotion. The course includes oral and written reports, group projects, panel discussions and field trips. (Wilbur.)

Clo. 127. Apparel Design. (3)

Second semester. One lecture and two laboratory periods a week. Prerequisite, Clo. 120. Laboratory fee, \$3.00. The art of costuming; trade and custom methods of clothing design and construction; advanced work in draping, pattern design and/or tailoring with study of the interrelationship of these techniques. (Staff.)

Clo. 128. Home Furnishings. (3)

First and second semesters. Three laboratory periods a week. Prerequisite, Tex. 1, Clo. 20, or consent of instructor. Laboratory fee, \$3.00. Selection of fabrics for home and institutional furnishings; care and repair of such furnishings; custom construction of slip covers, draperies, bedspreads; refinishing and upholstering a chair. (Wilbur.)

For Graduates

Tex. 200. Special Studies in Textiles. (2-4)

Second semester. Laboratory fee, \$3.00. (Staff.)

Clo. 220. Special Studies in Clothing. (2-4)

First semester. Laboratory fee, \$3.00. (Mitchell, Wilbur.)

Tex. and Clo. 230. Seminar. (1)

First and second semesters. Laboratory fee, \$3.00. (Mitchell.)

Tex. and Clo. 232. Economics of Textiles and Clothing. (3)

Second semester. Laboratory fee, \$3.00. (Mitchell.)

Tex. and Clo. 399. Research. (4-6)

First and second semesters. Laboratory fee, \$3.00. (Staff.)

HORTICULTURE

Professors: HAUT, KRAMER, LINK, SCOTT, SHANKS, STARK AND THOMPSON.

Associate Professor: REYNOLDS.

Assistant Professors: BRITTON AND WILEY.

This Department offers graduate work in the fields of Floriculture and Ornamental Horticulture Processing, Olericulture, and Pomology leading to the Master of Science or Doctor of Philosophy degrees.

Departmental requirements, supplementary to the material in the Graduate School Announcements have been formulated for the administration and guidance of graduate students. Copies of these requirements may be obtained from the Department.

For Graduates and Advanced Undergraduates

Hort. 101. Technology of Fruits. (3)

First semester. (Offered 1960-61.) Prerequisites, Hort. 6, Bot. 101. A critical analysis of research work and application of the principles of plant physiology, chemistry, and botany to practical problems in commercial production. (Thompson.)

Hort. 103. Technology of Vegetables. (3)

Second semester. (Offered 1959-60.) Prerequisites, Hort. 58, Bot. 101. For a description of these courses see the general statement under Hort. 101. (Stark.)

Hort. 105. Technology of Ornamentals. (2)

First semester. Prerequisite, Bot. 101. A study of the physiological plant processes as related to the growth, flowering, and storage of floricultural and ornamental plants. (Link.)

Hort. 107, 108. Woody Plant Materials. (3, 3)

First and second semesters. Prerequisite, Bot. 11. A field and laboratory study of trees, shrubs, and vines used in ornamental plantings. (Enright.)

Hort. 114. Systematic Horticulture. (3)

First semester, alternate years. (Offered 1959-60.) Two lectures and one laboratory period a week. A study of the origin, taxonomic relationship and horticultural classification of fruits and vegetables. (Britton.)

Hort. 123. Quality Control. (3)

First semester, alternate years. (Offered 1959-60.) Two lectures and one laboratory period a week. Principles involved in the evaluation of factors of quality in horticultural products including appearance, kinesthetic flavor and sanitation factors and statistical presentation of results. (Kramer.)

Hort. 124. Quality Control Systems. (3)

Second semester, alternate years. (Offered 1959-60.) Two lectures and one laboratory period a week. Prerequisite, Hort. 123. Development of quality control systems designed to maintain specific levels of quality for selected food products. (Kramer.)

Hort. 150, 151. Commercial Floriculture. (3, 3)

First and second semesters. Two lectures and one laboratory period a week. Prerequisite, Hort. 11. Growing and handling bench crops and potted plants, and the marketing of cut flowers. (Link.)

Hort. 155, 156. Fundamentals of Fruit and Vegetable Processing. (3, 3)

First and second semester, alternate years. (Offered 1960-61.) Two lectures and one laboratory period a week. Prerequisites, Chem. 32, 34, Hort. 61. Laboratory fee, \$5.00 per semester. The fundamentals of canning, freezing and preserving of horticultural crops with emphasis on the chemical, biochemical and microbiological aspects of processing. (Wiley.)

Hort. 159. Nursery Management. (3)

Second semester, alternate years. (Offered 1959-60.) Two lectures and one laboratory period a week. Prerequisites or concurrently, Hort. 62, 107, 108. A study of all phases of commercial nursery management and operations. (Enright.)

Horticulture

Hort. 160. Arboriculture. (3)

Second semester, alternate years. (Offered 1960-61.) Two lectures and one laboratory period a week. Prerequisites or concurrently, Hort. 107 and 108. A study of the planting and maintenance of ornamental shrubs and trees, including basic principles of park, institution and estate maintenance. (Enright.)

Hort. 161. Physiology of Maturation and Storage of Horticultural Crops. (2)

Second semester, alternate years. (Offered 1960-61.) Two lectures a week. Prerequisite, Bot. 101. Factors related to maturation and application of scientific principles to handling and storage of horticultural crops. (Scott.)

Hort. 198. Special Problems. (2, 2)

First and second semesters. Credit arranged according to work done. For major students in horticulture or botany. Four credits maximum per student. (Staff.)

For Graduates

Hort. 200. Experimental Procedures in Plant Sciences. (3)

First semester. Prerequisite, permission of instructor. Organization of research projects and presentation of experimental results in the field of biological science. Topics included will be: Sources of research financing, project outline preparation, formal progress reports, public and industrial supported research programs, and technical and popular presentation of research data. (Haut.)

Hort. 201, 202. Experimental Pomology. (3, 3)

First and second semesters. Prerequisite, Bot. 101. A systematic review of scientific knowledge and practical observations as applied to commercial practices in pomology. (Thompson.)

Hort. 203, 204. Experimental Olericulture. (2, 2)

First and second semesters. Prerequisite, Bot. 101. A systematic review of scientific knowledge and practical observations as applied to commercial practices in olericulture. (Stark.)

Hort. 205. Experimental Olericulture. (2)

First semester. Prerequisite, Bot. 101. A systematic review of scientific knowledge and practical observations as applied to commercial practices in olericulture. (Stark.)

Hort. 206. Experimental Floriculture. (3)

First semester. Prerequisite, Bot. 101. A systematic review of scientific knowledge and practical observations as applied to commercial practices in floriculture. (Link.)

Hort. 207. Methods of Horticultural Research. (3)

Second semester. One lecture and one four-hour laboratory period a week. A critical study of research methods which are or may be used in horticulture. (Scott.)

Hort. 210. Experimental Processing. (2)

Second semester. Prerequisite, permission of instructor. A systematic review of scientific knowledge and practical observations as applied to commercial practices in processing. (Kramer.)

Hort. 302. Advanced Seminar. (1)

First and second semesters. Oral reports with illustrative material are required on special topics or recent research publications in horticulture. Three credit hours maximum allowed toward the M. S. degree or six credits maximum toward the Ph.D. degree. (Haut and Staff.)

Hort. 399. Advanced Horticultural Research. (2-12)

First and second semesters. Credit granted according to work done. (Staff.)

MATHEMATICS

Professors: COHEN, FULLERTON, JACKSON, MARTIN, MAYOR AND STELLMACHER.
Research Professors: DIAZ*, MONTROLL* AND WEINSTEIN*.

Associate Professor: GOOD.

Associate Research Professors: DOUGLIS, LUDFORD* AND PAYNE*.

Assistant Professors: BRACE, EHRLICH, HORVATH, HUMMEL, PEARL AND ROSEN.

Assistant Research Professor: WEINBERGER*.

For admission to graduate study in mathematics the Department requires, in addition to the Graduate School requirements, an official transcript of the student's previous work for its files and evidence that the candidate for admission has received sufficient prior training in mathematics to indicate that he will be able successfully to undertake graduate training.

Before being recommended for admission to candidacy for the master's degree in mathematics, in addition to the Graduate School requirements, the student must demonstrate a reading knowledge of one foreign language of scientific importance and must have completed the major part of the course work required for the degree and must have received an average grade of "B" or better in all graduate courses taken.

A student preparing for the degree of Doctor of Philosophy with a major in mathematics will be offered a choice of two curricula, one with an emphasis on pure mathematics, the other with an emphasis on applied mathematics.

The Department requires successful completion of a preliminary oral examination before giving its recommendation for admission to candidacy for the doctorate. Before presenting himself for this examination the student is expected to have acquired a background of mathematical knowledge equivalent to the following group of graduate studies. In the pure mathematics curriculum: Algebra, six hours; Analysis, twelve hours; Geometry and Topology, six hours; Mathematical Methods or Mathematical Physics or Physics or (further) Analysis, six hours. In the applied mathematics curriculum: Analysis, eighteen hours (including Math. 286, 287, 288, 289, 212); Mathematical Methods, six hours; Mathematical Physics, six hours (including Math. 260); Algebra or Geometry or Topology as related to the student's individual work.

* Member of the Institute for Fluid Dynamics and Applied Mathematics.

A student who intends to present a minor in mathematics of more than nine credit hours for the degree of Doctor of Philosophy must include at least three credit hours of 200-level courses in mathematics. If the program includes more than twelve credit hours, at least six credit hours must be in 200-level courses in mathematics.

The Mathematics Department Colloquium meets frequently throughout the academic year for reports on current research by the resident staff, visiting lecturers, and graduate students. In addition the Institute for Fluid Dynamics and Applied Mathematics Colloquium meets at frequent intervals for reports on research in those fields. All colloquium meetings are open to the public.

A. ALGEBRA

For Graduates and Advanced Undergraduates

Math. 100. Higher Algebra. (3)

First semester. Prerequisite, Math. 21 or equivalent. The algebra of vector spaces and matrices, with emphasis upon those aspects of interest to students in applied mathematics. (Rieger.)

Math. 103, 104. Introduction to Modern Algebra. (3, 3)

Prerequisite, Math. 21 or equivalent. For Math. 104, the usual prerequisite of Math. 103 may be waived upon consent of instructor. In Math. 103 are studied the basic concepts of abstract algebra: integral domains, divisibility, congruences; fields, ordered fields; the fields of rational numbers, of real numbers, of complex numbers; polynomial domains over a field, including classical results on the theory of polynomial equations with rational, real, or complex coefficients; unique factorization domains, irreducibility criteria; rings. In Math. 104 are studied groups, vector spaces, linear transformations, matrices. (Ehrlich.)

Math. 106. Introduction to the Theory of Numbers. (3)

Summer school (2). Prerequisite, Math. 21 or equivalent. Integers, divisibility, Euclid's algorithm, Diophantine equations, prime numbers, Moebius function, congruences, residues. (Good.)

For Graduates

Math. 200, 201. Modern Algebra. (3, 3)

Prerequisite, Math. 103 or consent of instructor. Groups, rings, fields, algebraic numbers, Galois theory. (Pearl.)

Math. 202. Matrix Theory. (3)

Second semester. Prerequisite, Math. 103 or consent of instructor. The theory of vectors and matrices with applications. (Good.)

Math. 204, 205. Topological Groups. (3, 3)

Prerequisite, consent of instructor. An introductory course in abstract groups, topological spaces, and the study of collections of elements enjoying both these properties. The concept of a uniform space will be introduced and studied. The representation problem will be considered together with the subject of Lie groups. (Good.)

Math. 206. Number Theory. (3)

Prerequisite, consent of instructor. Foundations, linear and higher congruences, law of reciprocity, quadratic forms, sieve methods, elements of additive number theory and density, distribution of prime numbers and L-functions, discussion of unsolved problems. (Rieger.)

Math. 271. Selected Topics in Algebra. (3)

(Arranged.)

B. ANALYSIS*For Graduates and Advanced Undergraduates**Math. 110, 111. Advanced Calculus. (3, 3)*

Prerequisite, Math. 21 or equivalent. Limits and continuity of real and complex functions, Riemann integration, partial differentiation, line and surface integrals, infinite series, elements of vector analysis, elements of complex variable theory. Emphasis on problems and techniques. (Hummel.)

Math. 114. Differential Equations. (3)

Second semester. Prerequisite, Math. 110 or equivalent. Ordinary differential equations, symbolic methods, successive approximations, solutions in series, orthogonal functions, Bessel functions, Sturmian theory. (Martin.)

Math. 115. Partial Differential Equations. (3)

Prerequisite, Math. 114 or equivalent. Partial differential equations of first and second order, characteristics, boundary value problems, systems of equations, applications. (Martin.)

Math. 116. Introduction to Complex Variable Theory. (3)

Prerequisite, Math. 21 or equivalent. Open to students in engineering and the physical sciences. Graduate students in mathematics should enroll in Math. 286. Fundamental operations in complex numbers, differentiation and integration, sequences and series, power series, analytic functions, conformal mapping, residue theory, special functions. (Ludford.)

Math. 117. Fourier Series. (3)

Prerequisite, Math. 114 or equivalent. Representation of functions by series of orthogonal functions. Applications to the solution of boundary value problems of some partial differential equations of physics and engineering. (Ludford.)

*For Graduates**Math. 212. Special Functions. (3)*

Second semester. Prerequisite, Math. 287 or consent of instructor. Gamma function; second order differential equations in the complex domain, regular and irregular singularities; hypergeometric functions, Riemann's P-functions, Legendre functions, confluent hypergeometric functions, Whittaker functions, Bessel functions. (Diaz.)

Math. 215, 216. Advanced Differential Equations. (3, 3)

Prerequisites, Math. 100, 111 and 114, or consent of instructor. Existence and uniqueness theorems for systems of ordinary differential equations and for partial differential equations, characteristic theory, reduction to normal forms, the methods of finite differences. (Horvath.)

Math. 218. Integral Equations. (3)

First semester. Prerequisites, Math. 100 and 287, or consent of instructor. Integral equations of the first and second kind, Volterra's equation, Abel's equation and fractional differentiation; the Fredholm theory, the Hilbert-Schmidt theory, Mercer's theorem, expansion in orthonormal series; existence theorems of potential theory and other applications. (Douglass.)

Math. 272. Selected Topics in Analysis. (3)

(Arranged.)

Math. 278. Advanced Topics in Complex Analysis. (3)

Prerequisite, Math. 288 or consent of instructor. Material selected to suit interests and background of the students. Typical topics: Conformal mapping, algebraic functions, Riemann surfaces, entire functions, Dirichlet series, Taylor's series, geometric function theory. (Hummel.)

Math. 280, 281. Linear Spaces. (3, 3)

Prerequisite, Math. 287 or equivalent. Linear vector spaces and their topologies, linear operations and transformations and their inverses, Banach and Hilbert spaces. (Brace.)

Math. 286, 287. Theory of Functions. (3, 3)

Prerequisite, Math. 111 or equivalent. Basic topics in real and complex variable theory, real and complex number systems, point sets on the line and in space, continuity, Riemann and Stieltjes integrals, Cauchy integral theorem, residues, power series, analytic functions, introduction to Lebesgue measures and integration. (Rosen.)

Math. 288. Theory of Analytic Functions. (3)

Prerequisite, Math. 287 or a course in complex variables. Advanced topics in complex function theory, properties of power series, entire functions, conformal mapping, classification of singularities, harmonic functions. (Horvath.)

Math. 289. Measure and Integration. (3)

Prerequisite, Math. 287 or a course in real variables. Set functions, abstract theory of measure, differentiability properties and absolute continuity of set functions, measurable functions, abstract integration theory, introduction to linear spaces. (Cohen.)

C. GEOMETRY AND TOPOLOGY

For Graduates and Advanced Undergraduates

Math. 122, 123. Elementary Topology. (3, 3)

Prerequisite, Math. 21 or equivalent. Open and closed sets, elementary topology of the straight line and the Euclidean plane, the Jordan Curve Theorem and its applications, simple connectivity. (Correl.)

Math. 124, 125. Introduction to Projective Geometry. (3, 3)

Prerequisite, Math. 21 or equivalent. Elementary projective geometry largely from the analytic approach, projective transformations, cross ratio, harmonic division, projective coordinates, projective theory of conics, Laguerre's definition of angle.
(Mayor.)

Math. 126, 127. Introduction to Differential Geometry and Tensor Analysis. (3, 3)

Prerequisite, Math. 21 or equivalent. The differential geometry of curves and surfaces with the use of vector and tensor methods, curvature and torsion, moving frames, curvilinear coordinates, the fundamental differential forms, covariant derivatives, intrinsic geometry, curves on a surface, applications to problems in dynamics, mechanics, electricity, and relativity.
(Jackson.)

Math. 128, 129. Higher Geometry. (3, 3)

Prerequisite, Math. 21 or consent of instructor. Math. 128 is not a prerequisite for Math. 129. Open to students in the College of Education. This course is designed for students preparing to teach geometry in high school. The first semester is devoted to the modern geometry of the triangle, circle and sphere. In the second semester emphasis is placed on the axiomatic development of Euclidean and non-Euclidean geometry.
(Mayor.)

*For Graduates**Math. 220, 221. Differential Geometry. (3, 3)*

Prerequisite, Math. 111 and 152, or consent of instructor. Curves and surfaces, geometry in the large, the Gauss-Bonnet formula, surfaces of constant curvature.
(Jackson.)

Math. 223, 224. Algebraic Topology. (3, 3)

Prerequisites, Math. 103 and 123, or consent of instructor. Homology, cohomology, and homotopy theory of complexes and spaces.
(Fullerton.)

Math. 225, 226. Set-theoretic Topology. (3, 3)

Prerequisite, Math. 123 or consent of instructor. Foundations of mathematics based on a set of axioms, metric spaces, convergence and connectivity properties of point sets, continua and continuous curves, the topology of the plane.
(Fullerton.)

Math. 273. Selected Topics in Geometry and Topology. (3)

(Arranged.)

D. PROBABILITY AND STATISTICS*For Graduates and Advanced Undergraduates**Math. 130. Probability. (3)*

First semester. Prerequisite, Math. 21 or equivalent. Combinatory analysis, total, compound, and inverse probability, continuous distributions, theorems of Bernoulli and Laplace, theory of errors.
(Staff.)

Mathematics

Math. 132. Mathematical Statistics. (3)

Second semester. Prerequisite, Math. 21 or equivalent. Frequency distributions and their parameters, multivariate analysis and correlation, theory of sampling, analysis of variance, statistical inference. (Staff.)

Math. 133. Advanced Statistical Analysis. (3)

Second semester. Prerequisite, Math. 132 or equivalent. Advanced methods in correlation analysis, regression analysis, analysis of variance and sequential analysis, curve fitting, testing of hypotheses, non-parametric testing, machine tabulation in statistics. (Staff.)

E. HISTORY, LOGIC, AND FOUNDATIONS

For Graduates and Advanced Undergraduates

Math. 140. History of Mathematics. (3)

Summer session (2). Prerequisite, Math. 21 or consent of instructor. A survey of the historical development of mathematics and of the mathematicians who have contributed to that development. (Jackson.)

Math. 146. Fundamental Concepts of Mathematics. (3)

Prerequisite, Math. 21 or consent of instructor. Construction of the number system starting with the Peano Axioms for the natural numbers, development of the algebraic structures associated with the integers and rationals, theory of sets, equivalence classes, order relations, finite and infinite cardinals, positions of the various number systems in the hierarchy of order types. (Cohen.)

For Graduates

Math. 244. Mathematical Logic. (3)

Prerequisite, consent of instructor. Propositional calculus, predicate calculus and relations, formal deduction, the deduction theorem and the decision problem. (Keedy.)

F. MATHEMATICAL METHODS

For Graduates and Advanced Undergraduates

Math. 150, 151. Advanced Mathematics for Engineers and Physicists. (3, 3)

Prerequisite, Math. 21 or equivalent. An introduction to advanced mathematical methods and their application to the technical problems of physics and engineering. Topics include Fourier series, matrices, ordinary and partial differential equations of applied mathematics, numerical methods, Bessel functions, complex variables, operational calculus. (MacCarthy.)

Math. 152. Vector Analysis. (3)

Summer session (2). Prerequisite, Math. 21 or equivalent. Algebra and calculus of vectors and applications. (Esser.)

Math. 153. Operational Calculus. (3)

First semester. Prerequisite, Math. 21 or equivalent. Operational solutions of ordinary and partial differential equations, Fourier and Laplace transforms. (Esser.)

Math. 155. Numerical Analysis. (3)

First semester. Prerequisite, Math. 110 and 114, or consent of instructor. A brief survey of computing machines, study of errors involved in numerical computations, the use of desk machines and tables, numerical solution of polynomial and transcendental equations, interpolation, numerical differentiation and integration, ordinary differential equations, systems of linear equations. (Esser.)

Math. 156. Programming for High Speed Computers. (3)

Second semester. Prerequisite, Math. 21 or equivalent. General characteristics of high-speed automatic computers; logic of programming, preparation of flow charts, preliminary and final coding; scaling, use of floating point routines; construction and use of subroutines; use of machine for mathematical operations and for automatic coding. Each student will prepare and, if possible, run a problem on a high speed computer. (Sinkov.)

For Graduates

Math. 250. Tensor Analysis. (3)

First semester. Prerequisite, Math. 100 and 152, or consent of instructor. Algebra and calculus of tensors, Riemannian geometry and its extensions, differential invariants; applications to physics and engineering, and in particular the theory of relativity. (Stellmacher.)

Math. 251. Hilbert Space. (3)

First semester. Prerequisites, Math. 100 and 287, or consent of instructor. The original and general Hilbert space, scalar product, metric, strong and weak convergence, linear functionals, symmetric operators, complete continuity, eigenvalues, orthonormal systems, Schwartz-Bessel inequality and Parseval identity, eigenvalues in sub-spaces, spectral theorem. (Weinstein.)

Math. 252. Variational Methods. (3)

Second semester. Prerequisite, Math. 260 or consent of instructor. The Euler-Lagrange equation, minimal principles in mathematical physics, estimation of capacity, torsional rigidity and other physical quantities; symmetrisation, isoperimetric inequalities, estimation of eigenvalues; the minimax principle. (Payne.)

Math. 255, 256. Advanced Numerical Analysis. (3, 3)

Prerequisites, Math. 100 and 155, or consent of instructor. Review of numerical differentiation and integration, solution of ordinary differential equations, stability, accuracy, use of high-speed digital machines, properties of elliptic, hyperbolic and parabolic partial differential equations, conversion of partial differential equations to partial difference equations, rates of convergence of relaxation methods, gradient methods, iterative methods, the method of characteristics; general methods of solving problems, existence and unique theorems for difference equations associated with partial differential equations, stability of solutions, perturbation, iterative procedures, steepest descent, eigenvalue problems. (Staff.)

G. MATHEMATICAL PHYSICS

For Graduates and Advanced Undergraduates

Math. 160, 161. Analytic Mechanics. (3, 3)

Prerequisite, Math. 21 or equivalent. Statics, kinematics, dynamics of a particle, elementary celestial mechanics, Lagrangian equations for dynamical systems of one, two, and three degrees of freedom, Hamilton's principle, the Hamilton-Jacobi partial differential equation. (Martin.)

For Graduates

Math. 260. Foundations of Mathematical Physics. (3)

First semester. Prerequisite, consent of instructor. General survey of mathematical methods and results employed in various branches of mathematical physics. The following are among the general topics to be discussed: vector analysis and integral identities (Green-Gauss, Stokes, etc.), ordinary and partial differential and difference equations, integral equations, formulation of typical boundary and initial value problems and indication of the main methods of solution. (Diaz.)

Math. 261, 262. Fluid Dynamics. (3, 3)

Prerequisite, Math. 260 or consent of instructor. Basic kinematic and dynamic concepts, equation of continuity, velocity, potential and stream function, vorticity, Bernoulli's equation; perfect incompressible fluids, Helmholtz' vorticity theorems, plane hydrodynamics, Kutta-Joukowski theory of lift, conformal mapping, vortices and vortex streets, Prandtl-Munk theory of finite wings; viscous fluids, Navier-Stokes equations, boundary layer theory; perfect gases, method of characteristics, subsonic, transonic, and supersonic flows, hydrograph method, theory of shock waves. (Ludford.)

Math. 263, 264. Elasticity. (3, 3)

Prerequisites, Math. 100 and 260, or consent of instructor. Stress and strain, nuclei of strain, compatibility equations, Saint-Venant principle, bending, torsion and flexure of beams, complex variable methods, Airy's stress function, axial symmetry, strain energy and potential energy, buckling, bending, and vibration of plates and shells. (Payne.)

Math. 265. Hyperbolic Differential Equations. (3)

Second semester. Prerequisite, Math. 260 or consent of instructor. Two variables, Cauchy's problem, characteristics, Riemann's method, properties of the Riemann function, quasi-linear equations and canonical hyperbolic systems, wave equation in n -dimensions, methods of Hadamard and Riesz, Euler-Poisson equation and the singular problems, Huygens' principle. (Stellmacher.)

Math. 266. Elliptic Differential Equations. (3)

First semester. Prerequisite, Math. 260 or consent of instructor. The equations of Laplace and Poisson, flux, the theorems of Gauss and Green, potentials of volume and surface distributions, harmonic functions, Green's function and the problems of Dirichlet and Neumann; linear elliptic equations with variable coefficients, in particular the equations of Stokes and Beltrami; fundamental solutions, the principle of the maximum, and boundary value problems; introduction to the theory of non-linear equations. (Stellmacher.)

Math. 274. Selected Topics in Applied Mathematics. (3)
(Arranged.)

H. FOR TEACHERS OF MATHEMATICS AND SCIENCE

For Graduates and Advanced Undergraduates

Math. 181. Foundations of Number Theory. (3)

Summer session. Prerequisite, one year of college mathematics or consent of instructor. Designed primarily for those enrolled in programs with emphasis in the teaching of mathematics and science. Not open to students seeking a major directly in the physical sciences, since the course content is usually covered elsewhere in their curriculum. Axiomatic development of the real numbers. Elementary number theory. (Jackson.)

Math. 182. Foundations of Algebra. (3)

Summer session. Prerequisite, one year of college mathematics or consent of instructor. Designed primarily for those enrolled in programs with emphasis in the teaching of mathematics and science. Not open to students seeking a major directly in the physical sciences, since the course content is usually covered elsewhere in their curriculum. Modern ideas in algebra and topics in the theory of equations. (Cohen.)

Math. 183. Foundations of Geometry. (3)

Summer session. Prerequisite, one year of college mathematics or consent of instructor. Designed primarily for those enrolled in programs with emphasis in the teaching of mathematics and science. Not open to students seeking a major directly in the physical sciences, since the course content is usually covered elsewhere in their curriculum. A study of the axioms for Euclidean and non-Euclidean geometry. (Jackson.)

Math. 184. Foundations of Analysis. (3)

Summer session. Prerequisite, one year of college mathematics or consent of instructor. Designed primarily for those enrolled in programs with emphasis in the teaching of mathematics and science. Not open to students seeking a major directly in the physical sciences, since the course content is usually covered elsewhere in their curriculum. A study of the limit concept and the calculus. (Previous knowledge of calculus is not required.) (Good.)

Math. 199. National Science Foundation Summer Institute for Teachers of Science and Mathematics. Seminar. (1-3)

I. RESEARCH

For Graduates and Advanced Undergraduates

Math. 190, 191. Honors Reading Course. (3, 3)

Prerequisite, permission by the Department to work for honors. Selected reading on topics in mathematics of special interest to the student under the guidance of a staff member. (Cohen.)

For Graduates

Math. 298. Proseminar in Research. (1)

Second semester. Prerequisite, one semester of graduate work in mathematics. A seminar devoted to the foundations of mathematics, including mathematical logic, axiom systems, and set theory. (Douglas.)

Math. 399. Research.

(Arranged.)

(Staff.)

MECHANICAL ENGINEERING

Graduate Faculty: Professors: YOUNGER, JACKSON AND SHREEVE.

Associate Professor: ALLEN.

Assistant Professor: SAYRE.

Instruction and research facilities are available for the degrees of Master of Science and Doctor of Philosophy in Mechanical Engineering.

For the Master of Science degree in Mechanical Engineering, a minimum of six semester hours of course work in Mechanical Engineering must be taken in classes conducted by members of the resident graduate faculty. For the Doctor of Philosophy degree, the minimum is eighteen semester hours.

Registration for six credits of research (M.E. 221, Research) for the M.S. degree and twelve credits for the Ph.D. degree are required. It is the policy of the Department to require that this research be conducted in the Department laboratories. Arrangements for the research, and for faculty supervision, must be made, and approved by the Department Chairman, well in advance of the registration for the research in order that the funds and equipment may be made available.

For Advanced Undergraduates and Graduates

M. E. 100. Thermodynamics. (3)

First semester. Two lectures and one laboratory period a week. Prerequisites, Phys. 20, Math. 21, concurrently. Required of juniors in mechanical and aeronautical engineering. The properties, characteristics, and fundamental equations of gases, and vapors. Application of the first and second laws of thermodynamics in the analysis of basic heat engines, air compression, and vapor cycles. Flow and non-flow processes for gases and vapors. (Eyler, Sayre.)

M. E. 101. Heat Transfer. (3)

Second semester. Two lectures and one laboratory a week. Prerequisites, M.E. 100, M.E. 102 concurrently. Basic principles of heat transfer, including a study of conduction by steady state and variable heat flow; free and forced convection, radiation, evaporation and condensation of vapors, and the application of the principles of heat transfer to design problems. (Eyler, Allen.)

M. E. 102. Fluid Mechanics. (3)

Second semester. Laboratory fee, \$3.00. Two lectures and one laboratory a week. Prerequisites, M.E. 100. Fluid statics, Bernoulli's equation, principles of impulse and momentum analysis, measurements of flow and fluid properties, dimensional analysis and dynamic similitude, hydraulic machinery. (Sayre.)

M. E. 103. Metallography. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisites, M.E. 20, 21, 23. A study of the structure of metals and alloys as related to their properties. Study of crystallation, plastic deformation, constitution diagrams, heat treatment and effect of alloying elements on ferrous and non-ferrous materials. Laboratory work in thermal analysis, microscopy heat treatment and testing of metals. (Jackson, Eylér.)

M. E. 104. Kinematics. (2)

Second semester. One lecture and one laboratory period a week. Prerequisites, M.E. 24, Math. 21. A study of velocity, acceleration, and displacement of mechanisms, cam motion, gearing and gear trains. (Jackson, Hayleck.)

M. E. 105. Principles of Mechanical Engineering. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisites, Phys. 21, Math. 21. Required of juniors in civil engineering. Elementary thermodynamics and the study of heat, fuel and combustion in the production and use of steam for generation of power. Supplemented by laboratory tests and trips to industrial plants. (Cather, Hurlbrink.)

M. E. 107. Heat Power—Chemical and Nuclear. (4)

Second semester. Three lectures and one laboratory period a week. Laboratory fee, \$3.00 per semester. Required of seniors in electrical engineering. Prerequisite, M.E. 100. The study of power plant cycles using as heat sources nuclear reactors, solid, liquid and gaseous fuels. Includes analysis and design of such equipment as: reactors, boilers, turbines, regenerators and their accessories. (Cather, Hurlbrink.)

M. E. 150, 151. Heat Power—Chemical and Nuclear. (4, 4)

First and second semesters. Three lectures and one laboratory period a week. Prerequisites, M.E. 100; M.E. 102, concurrently. Required of seniors in mechanical engineering. The study of all types of power plants including internal combustion engines, gas turbines, and steam stations; using all types of heat sources including nuclear reactors, solid, liquid and gaseous fuels. Includes the study of such cycles as Otto, Diesel, Brayton, and Rankine. Analysis and design of various components such as: reactors, regenerators, turbines, compressors, boilers and condensers. (Shreeve, Cather.)

M. E. 152, 153. Mechanical Engineering Design. (4, 3)

First semester. Two lectures and two laboratory periods a week. Second semester. Two lectures and one laboratory period a week. Prerequisites, M.E. 103, M.E. 104. Design of machine elements. Machine design projects. Mechanical vibrations. (Jackson, Hayleck.)

M. E. 154, 155. Mechanical Laboratory. (2, 2)

First and second semesters. One lecture and one laboratory period a week. Laboratory

Mechanical Engineering

fee, \$3.00 per semester. Prerequisite, senior standing. Required of seniors in mechanical engineering. Experiments on fuels and lubricants, steam engine and turbines, air compressors, gasoline and diesel engines and various other mechanical equipment. Written reports are required on all tests. (Staff.)

M. E. 156. Heating and Air Conditioning. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisites, M.E. 100; M.E. 101, concurrently. The fundamentals of heating and cooling load computations. Basic information on heating and air conditioning systems for residential and industrial use. (Allen, Eyster.)

M. E. 157. Refrigeration. (3)

First semester. Laboratory fee, \$3.00 per semester. Two lectures and one laboratory period a week. Prerequisites, M.E. 100, M.E. 101, M.E. 156; M.E. 102 concurrently. Thermodynamic analysis of air, vapor compression, absorption and water refrigeration systems. Characteristics of refrigerants. Study of refrigeration as applied to cooling and dehumidification in air conditioning. Low temperature refrigeration, the heat pump, and other special topics. (Allen, Eyster.)

M. E. 158, 159. Applied Elasticity. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Math. 64, M.E. 23. Advanced strength of materials involving beam problems, curved bars, flat plates, shells, statically indeterminate structures. Methods of work and energy. (Younger.)

M. E. 160, 161. Advanced Dynamics. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Math. 64, M.E. 24. Linear, plane and three dimensional motion, moving axes, Lagrange's equation, Hamilton's principle, balancing, vibration, gyroscope, etc. (Younger.)

M. E. 162, 163. Advanced Thermodynamics. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, M.E. 100, 102; Math. 64. Advanced problems in thermodynamics on compression of gases and liquids, combustion and equilibrium. Problems in advanced heat transfer. (Allen, Shreeve.)

M. E. 164. Research. (3)

First and second semesters. Prerequisite, "B" average and senior standing in mechanical engineering. Arrangements must be made in advance of registration. (Staff.)

M. E. 165. Creative Engineering. (3)

First and second semesters. Prerequisite, senior standing in mechanical engineering. Solving design problems in engineering with emphasis on the creative approach. (Shreeve.)

M. E. 166, 167. Advanced Fluid Mechanics. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, M.E. 102, Math. 64. Hydrodynamic theory, Navier Stokes equations, subsonic and supersonic compressible flow, normal shock theory. Engineering applications. (Sayre.)

For Graduates

M. E. 200, 201. *Advanced Dynamics.* (3, 3)

First and second semesters. Prerequisites, M.E. 24, Math. 64, M.E. 153, M.E. 155. Mechanics of machinery. Dynamic forces. Balancing of rotating parts. Vibrations and vibration damping. Critical speeds. (Younger.)

M. E. 202, 203. *Applied Elasticity.* (3, 3)

First and second semesters. Prerequisites, M.E. 23, Math. 64, M.E. 153. Advanced methods in structural and experimental stress analysis. Advanced strength of materials involving beam problems, curved bars, thin plates and shells, buckling of bars, plates and shells, etc. Advanced work in stress concentrations, plastic deformations, etc., and problems involving instability of structures. (Younger.)

M. E. 204, 205. *Advanced Thermodynamics.* (3, 3)

First and second semesters. Three lectures a week. Prerequisites, M.E. 101, M.E. 151, Math. 64. Advanced problems in thermodynamics on compression of gases and liquids, combustion and equilibrium, humidification and refrigeration and availability. Problems in advanced heat transfer covering the effect of radiation, conduction, and convection, steady and unsteady flow, evaporation and condensation. (Shreeve, Allen.)

M. E. 206, 207. *Advanced Machine Design.* (3, 3)

First and second semesters. Two lectures and one laboratory period a week. Prerequisites, Math. 64, M.E. 153. Application of advanced methods of stress analysis to design of special stationary and moving machine parts, including rotating disks, bearings, thick wall cylinders, screw fastenings, crankshafts, etc. Application of linear and torsional vibration and balancing in the design of machine members. Complete design of a machine. Study of current design literature. (Jackson.)

M. E. 208, 209. *Steam Power Design.* (3, 3)

First and second semesters. One lecture and two laboratory periods a week. Prerequisite, M.E. 151. Design and specifications of power plants with special emphasis on central stations heated by conventional fuels and nuclear reactors. Design of all components including turbines, boilers, and reactors. Problems of water treatment and waste disposal (atomic and ash) are considered. (Shreeve.)

M. E. 210, 211. *Advanced Fluid Mechanics.* (3, 3)

First and second semesters. Prerequisites, M.E. 102, Math. 64. Advanced theory of the flow of fluids and gases. Hydrodynamic theory. Engineering applications. (Sayre.)

M. E. 212, 213. *Advanced Steam Power Laboratory.* (2, 2)

First and second semesters. One lecture and one laboratory period a week. Prerequisite, registration in M.E. 204, 205. Research on advanced steam power problems to illustrate and advance steam power theory. Power plant heat balances. (Shreeve.)

M. E. 214, 215. *Advanced Applied Mechanics Laboratory.* (2, 2)

First and second semesters. One lecture and one laboratory period a week. Prerequisites, registration in M.E. 200, 201 and M.E. 202, 203. Illustrative experiments and research on difficult problems in stress analysis. Photoelasticity. Mechanical vibrations. Critical speeds. Dynamic stresses. Fatigue of materials. (Younger.)

Mechanical Engineering

M. E. 216, 217. *Advanced Internal Combustion Engine Design.* (3, 3)

First and second semesters. One lecture and two laboratory periods a week. Prerequisites, M.E. 150, 151; M.E. 152, 153 and registration in M.E. 200, 201 and M.E. 204, 205. Each student will carry out complete designs of internal combustion engines. (Shreeve.)

M. E. 218, 219. *Advanced Internal Combustion Engine Laboratory.* (2, 2)

First and second semesters. One lecture and one laboratory period a week. Prerequisite, registration in M.E. 216, 217. Advanced laboratory tests and problems in the design of internal combustion engines. (Shreeve.)

M. E. 220. *Seminar.*

Credit in accordance with work outlined by the staff of the Department of Mechanical Engineering. Prerequisite, graduate standing in mechanical engineering. (Staff.)

M. E. 222. *Advanced Metallography.* (3)

First semester. Two lectures and one laboratory period a week. Prerequisites, M.E. 103, M.E. 23. Advanced study of the structure and properties of metals and alloys. Study of the latest developments in ferrous and non-ferrous alloys including stainless steels, high temperature steels, tool steels, aluminum, magnesium and copper alloys. Study of inspection of metals by the use of x rays, spectograph, metallograph and magniflux. Review of current literature. (Jackson.)

M. E. 223, 224. *Steam and Gas Turbine Design.* (3, 3)

First and second semesters. Three lectures a week. Prerequisites, M.E. 101, M.E. 151, Math. 64. Study of nozzles and blades, with application to all types of turbines and compressors based on detailed heat calculations. Design of regenerators and combustors for gas turbines. Applications to jet propulsion. Fundamentals of rocket, pulse jet and ram jet design. (Shreeve.)

M. E. 225, 226. *Advanced Properties of Metals and Alloys.* (2, 2)

First and second semesters. Two lectures a week. Prerequisites, M.E. 23, M.E. 103, M.E. 152, M.E. 153. Properties of metals including tensile, impact, fatigue, damping capacity, hardenability, wear, etc. Fabrication problems and selection of metals and alloys. Service failures. Properties required for nuclear engineering applications. Properties of metals at elevated and extremely low temperatures. (Jackson.)

M. E. 227, 228. *Theory of Elasticity.* (3, 3)

First and second semesters. Three lectures a week. Prerequisites, M.E. 202, 203. Stress and strain at a point. Relation between stresses and strains, general equations of elasticity, plane strain and plane stress, torsion, bending, axially symmetric distribution of stress, plates, thermal stresses, strain energy and approximate methods. (Younger.)

M. E. 229, 230. *Jet Propulsion.* (3, 3)

First and second semesters. Three lectures a week. Prerequisites, M.E. 101, M.E. 150, M.E. 151. Types of thermal jet units. Fluid reaction and propulsive efficiency. Performance of rockets, aerothermodynamics, combustion chemical kinetics, aerodynamics of high speed air flow. Principles and design of solid and liquid propellant rockets. Design of turbojets and aerojets, ramjets and hydroduct units, including combustion chambers, turbines and compressor. (Shreeve.)

M. E. 231, 232. Advanced Heat Transfer. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, M.E. 101. Advanced problems covering effects of radiation, conduction, convection, evaporation and condensation. Study of research literature on heat transfer. (Shreeve, Allen.)

M. E. 233, 234. Compressible Flow. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, M.E. 210, 211 or equivalent. One and two dimensional subsonic, transonic, and supersonic flow. (Sayre.)

M. E. 399. Research.

Credit in accordance with work outlined by the staff of the Department of Mechanical Engineering. Prerequisite, graduate standing in mechanical engineering. Research in any field of mechanical engineering as applied mechanics, heat transfer, thermodynamics, heat, power, etc. (Staff.)

MICROBIOLOGY

Professors: FABER, HANSEN AND PELCZAR.

Associate Professors: LAFFER AND DOETSCH.

Visiting Professor: GORDON.

The Department of Microbiology offers the degrees of Master of Science and Doctor of Philosophy.

Graduate students associated with institutions away from the College Park campus are required to take a minimum of 12 credit hours, exclusive of research, during one semester at College Park for the degree of Master of Science, and a minimum of 24 credit hours, exclusive of research, during two semesters at College Park for the degree of Doctor of Philosophy.

The research project, the experimental approach employed, and progress made must meet with the approval of the Head of the Department.

Further information concerning graduate work in microbiology may be obtained from the Department.

For Graduates and Advanced Undergraduates

Microb. 101. Pathogenic Microbiology. (4)

First semester. Two lecture and two two-hour laboratory periods a week. Prerequisite, Microb. 5. Laboratory fee, \$10.00. The role of microorganisms in the diseases of man and animals with emphasis upon the differentiation and culture of microorganisms, types of disease, modes of disease transmission; prophylactic, therapeutic and epidemiological aspects. (Faber.)

Microb. 103. Serology. (4)

Second semester. Two lecture and two two-hour laboratory periods a week. Prerequisite, Microb. 101. Laboratory fee, \$10.00. Infection and resistance; principles and types of immunity; hypersensitiveness. Fundamental techniques of major diagnostic immunological reactions and their application. (Faber.)

Microb. 104. History of Microbiology. (1)

First semester. One lecture period a week. Prerequisite, a major or minor in microbiology. History and integration of the fundamental discoveries of the science. The modern aspects of cytology, taxonomy, fermentation, and immunity in relation to early theories. (Doetsch.)

Microb. 105. Clinical Methods. (4)

First semester. Two lecture and two two-hour laboratory periods a week. Prerequisite, consent of instructor. Laboratory fee, \$10.00. A practical course designed to integrate clinical laboratory procedures in terms of hospital and public health demands. (Faber.)

Microb. 108. Epidemiology and Public Health. (2)

Second semester. Two lecture periods a week. Prerequisite, Microb. 1. History, characteristic features, and epidemiology of the important communicable diseases; public health administration and responsibilities; vital statistics. (Faber.)

Microb. 121. Advanced Methods. (4)

Second semester. Two lectures and two two-hour laboratory periods a week. Prerequisite, consent of instructor. Laboratory fee, \$10.00. The application of quantitative techniques for the measurement of enzyme reactions, mutations, fermentation analyses and other physiological processes of microorganisms. (Hansen and Pelczar.)

Microb. 131. Food and Sanitary Microbiology. (4)

Second semester. Two lecture and two two-hour laboratory periods a week. Prerequisite, Microb. 1. Laboratory fee, \$10.00. The relationship of microorganisms to fresh and preserved food and methods of control. Bacteriological and public health aspects of water supplies and sewage disposal, restaurant and plant sanitation, insect and rodent control. (Laffer.)

Microb. 133. Dairy Microbiology. (4)

First semester. Two lecture and two two-hour laboratory periods a week. Prerequisite, Microb. 1. Laboratory fee, \$10.00. Relation of bacteria, yeasts, and molds to milk, cream, butter, ice cream, cheese, and other dairy products. Standard methods of examination, public health requirements, plant sanitation. Occasional inspection trips. (Doetsch.)

Microb. 135. Soil Microbiology. (4)

Second semester. Two lecture and two two-hour laboratory periods a week. Prerequisite, Microb. 1. Laboratory fee, \$10.00. The role played by microorganisms in the soil; nitrification, denitrification, nitrogen-fixation, and decomposition processes; cycles of elements; relationships of microorganisms to soil fertility. (Hansen.)

Microb. 150. Microbial Physiology. (2)

Second semester. Two lecture periods a week. Prerequisite, 8 credits in microbiology. Aspects of the growth, death, and energy transactions of microorganisms are considered, as well as the effects of the physical and chemical environment on them. (Doetsch.)

Microb. 161. Systematic Bacteriology. (2)

First semester. Two lecture periods a week. Prerequisite, 8 credits in microbiology. History of bacterial classification; international codes of nomenclature; bacterial variation as it affects classification. (Hansen.)

Microb. 181. Microbiological Problems. (3)

First and second semesters; summer session. Prerequisite, 16 credits in microbiology. Laboratory fee, \$10.00. Registration only upon the consent of the instructor. This course is arranged to provide qualified majors in microbiology and majors in allied fields an opportunity to pursue specific microbiological problems under the supervision of a member of the Department. (Faber.)

*For Graduates**Microb. 201. Medical Mycology. (4)*

First semester. Two lecture and two two-hour laboratory periods a week. Prerequisite, 30 credits in microbiology and allied fields. Laboratory fee, \$10.00. Primarily a study of the fungi associated with disease and practice in the methods of isolation and identification. (Laffer.)

Microb. 202. Genetics of Microorganisms. (2)

Second semester. Two lecture periods a week. Prerequisite, consent of instructor. An introduction to genetic principles and methodology applicable to microorganisms. Spontaneous and induced mutations, interaction between clones. (Hansen.)

Microb. 204. Bacterial Metabolism. (2)

First semester. Two lecture periods a week. Prerequisites, 30 credits in microbiology and allied fields, including Chem. 161 and 162. Bacterial nutrition, enzyme formation, metabolic pathways and the dissimilation of carbon and nitrogen substrates. (Pelczar.)

Microb. 206, 208. Special Topics. (1, 1)

First and second semesters. One lecture period a week. Prerequisite, 20 credits in microbiology. Presentation and discussion of fundamental problems and special subjects in the field of microbiology. (Staff.)

Microb. 210. Virology and Tissue Culture. (2)

Second semester. Two lecture periods a week. Prerequisite, Microb. 101 or equivalent. Characteristics and general properties of viruses and rickettsiae. Principles of tissue culture. (Gordon.)

Microb. 211. Virology and Tissue Culture Laboratory. (2)

Second semester. Two three-hour laboratory periods a week. Prerequisite, Microb. 101 or equivalent. Laboratory fee, \$20.00. Registration only upon consent of instructor. Laboratory methods in virology and tissue culture. (Gordon.)

Microb. 214. Advanced Bacterial Metabolism. (1)

Second semester. One lecture period a week. Prerequisite, Microb. 204 and consent of instructor. A discussion of recent advances in the field of bacterial metabolism with emphasis on metabolic pathways of microorganisms. (Pelczar.)

Microb. 280. Seminar—Research Methods. (1)

First semester. Discussions and reports by majors in microbiology engaged in current research; presentations of selected subjects dealing with recent advances in microbiology. (Staff.)

Music

Microb. 282. Seminar—Microbiological Literature. (1)

Second semester. Presentation and discussion of current literature in microbiology. (Staff.)

Microb. 399. Research.

First and second semesters; summer session. Credits according to work done. Laboratory fee, \$10.00. The investigation is outlined in consultation with, and pursued under, the supervision of a senior staff member of the Department. (Staff.)

MUSIC

Professors: ULRICH, GRENTZER AND RANDALL.

Associate Professors: JORDAN.

Assistant Professors: BERMAN AND HENDERSON.

Certain courses in the Department of Music numbered 100 and above may be taken by candidates for graduate degrees in the College of Education. Students should consult their graduate advisors for details.

For Graduates and Advanced Undergraduates

Mus. 120, 121. History of Music. (3, 3)

First and second semesters. Prerequisites, Mus. 1 or 20 and junior standing. A study of musical styles from their origins in western Europe to their present-day manifestations. The interaction of music and other cultural activities. Mus. 120, the Greek period to Bach; Mus. 121, Bach to the present. (Jordan.)

Mus. 141, 142. Musical Form. (2, 2)

First and second semesters. Prerequisites, Mus. 70, 71. A study of the organizing principles of musical composition, their interaction in musical forms, and their functions in different styles. Mus. 141, the phrase to the rondo; Mus. 142, the larger forms. (Jordan.)

Mus. 143, 144. Composition. (2, 2)

First and second semesters. Prerequisites, Mus. 70, 71. The principles of musical composition, and their application to the smaller forms. Original writing in nineteenth- and twentieth-century musical idioms for various media.

Mus. 145, 146. Counterpoint. (2, 2)

First and second semesters. Prerequisites, Mus. 70, 71. A course in eighteenth-century contrapuntal techniques. Study of devices of imitation in the invention and the choral prelude. Original writing in the smaller contrapuntal forms. (Bernstein.)

Mus. 147, 148. Orchestration. (2, 2)

First and second semesters. Prerequisites, Mus. 70, 71. A study of the ranges, musical functions, and technical characteristics of the instruments, and their color possibilities in various combinations. Practical experience in orchestrating for small and large ensembles. (Jordan.)

Mus. 150. Keyboard Harmony. (2)

First semester. Prerequisites, Mus. 70, 71. One lecture and two laboratory hours per week. The application to the piano keyboard of the harmonic principles acquired in Mus. 70 and 71. Harmonization of melodies, improvisation and accompanying, playing from dictation, and transposition. (Meyer.)

Mus. 160, 161. Conducting. (2, 2)

First and second semesters. Mus. 160 or the equivalent is prerequisite to Mus. 161. A laboratory course in conducting vocal and instrumental groups. Baton technique, score reading, rehearsal techniques, tone production, style, and interpretation. Music of all periods will be introduced. (Grentzer, Henderson.)

Mus. 166. Survey of the Opera. (3)

Second semester. Prerequisites, Mus. 120, 121 or the equivalent. A study of the music, librettos, and composers of the standard operas. (Randall.)

Mus. 167. Symphonic Music. (3)

First semester; summer session (2). Prerequisites, Mus. 120, 121 or the equivalent. The study of orchestral music from the Baroque period to the present. The concerto, symphony, overture, and other forms are examined. (Jordan.)

Mus. 168. Chamber Music. (3)

Second semester. Prerequisites, Mus. 120 and 121 or the equivalent. The history and literature of chamber music from the early Baroque period to the present. Music for trio sonata, string quartet and quintet, and combinations of piano and string instruments is studied. (Ulrich.)

Mus. 169. Choral Music. (3)

First semester. Prerequisites, Mus. 120 and 121 or the equivalent. The history and literature of choral music from the Renaissance to the present, with discussion of related topics such as Gregorian chant, vocal chamber music, etc. (Jordan.)

For Graduates

Mus. 200. Advanced Studies in the History of Music. (3)

First semester. Prerequisites, Mus. 120, 121, and consent of instructor. A critical study of one style period (Renaissance, Baroque, etc.) will be undertaken. The course may be repeated for credit, since a different period will be chosen each time it is offered. (Jordan.)

Mus. 201. Seminar in Musicology. (3)

Prerequisites, Mus. 120, 121, and consent of instructor. The work of one major composer (Bach, Beethoven, etc.) will be studied, with emphasis on musicological method. The course may be repeated for credit, since a different composer will be chosen each time it is offered. (Jordan.)

PHILOSOPHY

Professor: GARVIN.

Associate Professor: LAVINE.

Assistant Professor: SCHLARETZKI.

The Department of Philosophy offers the degrees of Master of Arts and Doctor of Philosophy.

A statement of departmental requirements for these degrees, supplementary to the requirements of the Graduate School, may be obtained on request from the Department.

Courses numbered below 150 will not be accepted for graduate credit in a philosophy major.

For Graduates and Advanced Undergraduates

Phil. 101. Ancient Philosophy. (3)

First semester. A history of Greek thought from its beginnings to the time of Justinian. The chief figures discussed: the Presocratic philosophers, Socrates, Plato, Aristotle, Epicurus, the Stoic philosophers and Plotinus. (Diamadopoulos.)

Phil. 102. Modern Philosophy. (3)

Second semester. A history of philosophical thought in the West during the 16th, 17th, and 18th centuries. The chief figures discussed: Bacon, Galileo, Descartes, Spinoza, Leibniz, Locke, Berkeley, Hume and Kant. (Schlaretzki, Lavine.)

Phil. 120. Oriental Philosophy. (3)

Second semester. A brief survey of Indian and Chinese philosophy. Discussion of Indian thought will center about the Rig-Veda, the Upanishads, the Buddhist philosophers, and the chief Hindu systems. Discussion of Chinese thought will center about Confucius, Lao-tse and their disciples, particular attention being given to the development of democratic ideals from Mencius to Sun Yat-sen. (Staff.)

Phil. 123, 124. Philosophies Men Live By. (2, 2)

First and second semesters. Phil. 123, extension (3). Designed as electives for students who wish to acquaint themselves with the field of philosophy. Phil. 123 not necessarily a prerequisite for Phil. 124. An exploration of the fundamental beliefs which determine what men make of their lives and of the world they live in. Each semester classic statements of these beliefs by great philosophers will be chosen for class discussion on the basis of their significance for the problems confronting modern man. (Staff.)

Phil. 125. The Great Philosophers. (3)

Offered in Baltimore only. A discussion of the ideas of the great Western philosophers, based on readings in their works. (Staff.)

Phil. 130. The Conflict of Ideals in Western Civilization. (3)

First semester. A critical and constructive philosophical examination of the assumptions, goals, and methods of contemporary democracy, fascism, socialism, and communism, with special attention to the ideological conflict between the United States and Russia. (Schlaretzki.)

Phil. 140. Philosophical Bases of Educational Theories. (3)

Second semester. A critical study of the foundations of major views regarding the proper ends of education and the implications of these views for educational practice. (Staff.)

Phil. 145. Ethics. (3)

Second semester. A critical study of the problems and theories of human conduct, aimed at developing such principles of ethical criticism as may be applied to contemporary personal and social problems and to the formulation of an ethical philosophy of life. (Schlaretzki, Garvin.)

Phil. 147. Philosophy of Art. (3)

Second semester. An inquiry into the nature and functions of art. The course will begin with an examination of the relations between art and imitation, art and craft, art and beauty, art and pleasure, art and form, art and expression, art and not-art, and good, bad, and great art, and conclude with a consideration of the uses of art, propagandistic, religious, escapist, and therapeutic. (Garvin.)

Phil. 152. Philosophy of Social and Historical Change. (3)

First semester. A survey and an assessment of the religious, the philosophic, and the scientific approaches to socio-historic change, including the theories of linear progress, evolutionary progress, cyclical repetition, Hegelian-Marxian dialectic, Weberian secularization and bureaucratization. (Lavine.)

Phil. 154. Political and Social Philosophy. (3)

Second semester. An inquiry into the nature and functions of society and of the state. Attention is given to the major classical and contemporary theories, but the course is not primarily historical. The central problems: determination of the grounds of political obligation; reconciliation of the claims of personal freedom and social welfare. (Schlaretzki.)

Phil. 155. Logic. (3)

Second semester. A critical exposition of deductive logic. The course includes an examination and appraisal of Aristotelian logic and a systematic presentation of the foundations of modern symbolic logic. Consideration is given to the application of the techniques of logic in the organization of knowledge and in scientific method. (Garvin.)

Phil. 156. Philosophy of Science. (3)

First semester. An inquiry into the relations of the sciences, the nature of observation, hypotheses, verification, experiment, measurement, scientific laws and theories, the basic concepts and presuppositions of science, and the relations of science to society. (Lavine.)

Phil. 158. Philosophy of Language. (3)

Second semester. An inquiry into the nature and function of language and other forms of symbolism. (Schlaretzki.)

Philosophy

Phil. 160. *Medieval Philosophy*. (3)

First semester. A history of philosophical thought in the West from the close of the Classical period to the Renaissance. Based upon readings in the Stoics, early Christian writers, Neoplatonists, later Christian writers and Schoolmen. (Staff.)

Phil. 162. *American Philosophy*. (3)

Second semester. A survey of American philosophical thought from the 18th century to the present. Special attention is given to Edwards, Jefferson, Emerson, Royce, Peirce, James, Dewey and Santayana. (Schlaretzki.)

Phil. 163. *Nineteenth Century Idealism*. (3)

First semester. A survey of idealist thought following Kant: the Romantic Idealists, Hegel, Schopenhauer, Nietzsche, the British School. (Garvin.)

Phil. 164. *Contemporary Movements in Philosophy*. (3)

First semester. A survey of recent and present developments in philosophy. Attention will be given to such thinkers as James, Bergson, Russel, Dewey, and Whitehead and to such movements as Pragmatism, Idealism, Naturalism, Positivism, and Existentialism. Particular consideration will be paid to the bearing of these developments on contemporary problems of science, religion and society. (Garvin.)

Phil. 166. *The Philosophy of Plato*. (3)

First semester. Prerequisite, Phil. 101 or consent of the instructor. A critical study of selected dialogues. (Diamadopoulos.)

Phil. 167. *The Philosophy of Aristotle*. (3)

Second semester. Prerequisite, Phil. 101 or consent of the instructor. A critical study of selected portions of Aristotle's writings. (Diamadopoulos.)

Phil. 168. *The Philosophy of Kant*. (3)

First semester. Prerequisite, Phil. 102 or consent of the instructor. A critical study of selected portions of Kant's writings. (Staff.)

Phil. 170. *Metaphysics*. (3)

First semester. Prerequisite, 3 hours of philosophy. A critical study of rival metaphysical theories. Analysis of basic metaphysical categories and methods. (Staff.)

Phil. 171. *Epistemology*. (3)

Second semester. Prerequisite, 3 hours of philosophy. Systematic analysis of the central problems in the theory of knowledge. Idealism, realism, phenomenism, pragmatism, empiricism, rationalism, positivism, and language analysis will be discussed in the light of contemporary developments. (Staff.)

Phil. 175. *Symbolic Logic*. (3)

First semester. Prerequisite, Phil. 41 or 155 or consent of the instructor. A study of the historical development of symbolic logic and a careful analysis of recent systems and techniques. (Garvin.)

Phil. 191, 192, 193, 194. *Topical Investigations*. (1-3)

Each semester. (Staff.)

For Graduates

Phil. 215. Advanced Philosophy of Religion. (3)

First semester. Prerequisite, consent of instructor. Philosophical consideration of selected problems. (Staff.)

Phil. 220. Inductive Logic and Scientific Method. (3)

Second semester. Prerequisite, consent of instructor. An examination of the logic of scientific procedure and of the structure and validity of scientific generalization. (Lavine.)

Phil. 230. The British Empiricists. (3)

First semester. Prerequisite, consent of instructor. A critical study of selected writings of Locke, Berkeley, and Hume. (Staff.)

Phil. 232. The Continental Rationalists. (3)

Second semester. Prerequisite, consent of the instructor. A critical study of the systems of some of the major 17th and 18th century rationalists, with special reference to Descartes, Spinoza, and Leibniz. (Staff.)

Phil. 255. Seminar in the History of Philosophy. (1-3)

First semester. Prerequisite, consent of instructor. (Staff.)

Phil. 256. Seminar in the Problems of Philosophy. (1-3)

Second semester. Prerequisite, consent of instructor. (Staff.)

Phil. 260. Seminar in Ethics. (3)

First semester. Prerequisite, consent of instructor. An examination of representative ethical theories. (Staff.)

Phil. 261. Seminar in Aesthetics. (3)

Second semester. Prerequisite, consent of instructor. An examination of representative aesthetic theories. (Staff.)

Phil. 292. Selected Problems in Philosophy. (1-3)

Each semester. Prerequisite, consent of instructor. (Staff.)

Phil. 399. Research. (1-12)

Each semester. (Staff.)

PHYSICAL EDUCATION, RECREATION AND HEALTH

Professors: FRALEY, DEACH, HUMPHREY, JOHNSON, MASSEY AND MOHR.

Associate Professors: EYLER AND HARVEY.

The graduate student majoring in Physical Education, Recreation, or Health Education may pursue any of the following degrees: Master of Arts in Physical Education, Doctor of Education, and Doctor of Philosophy. Undergraduate requirements to be met by every candidate before admission to candidacy for a graduate degree in Physical Education are: basic sciences (human anatomy

and physiology, physiology of exercise), kinesiology, therapeutics, sport skills, methods, human development, measurement, administration, and student teaching. In cases where a student has had successful experience in teaching physical education, the prerequisites of sport skills, methods, and student teaching may be waived. Undergraduate prerequisites in Recreation are: psychology, sociology, principles, administration, basic sciences, recreational activities, and practical experience. Undergraduate prerequisites in Health Education are: biological sciences, bacteriology, human anatomy and physiology, nutrition, chemistry, psychology, measurement, administration, principles, and field work.

Every graduate student majoring in Physical Education, Recreation, or Health Education is required to take the following courses (or transfer their equivalent) before taking the qualifying examination; P. E. 201, Foundations in Physical Education, Recreation and Health; P. E. 210, Methods and Techniques of Research; and P. E. 196, Quantitative Methods or P. E. 230, Source Material Survey. In addition, every graduate student must register for and complete P. E. 200, Seminar in Physical Education, Recreation, and Health, at some time during his graduate program.

A. PHYSICAL EDUCATION

For Graduates and Advanced Undergraduates

P. E. 100. Kinesiology. (4)

First and second semesters; summer session. Three lectures and two laboratory hours a week. Prerequisites, Zool. 1, 14, and 15, or the equivalent. (Massey.)

P. E. 120. Physical Education for the Elementary School. (3)

First and second semesters; summer session. (Humphrey.)

P. E. 155. Physical Fitness of the Individual. (3)

First and second semesters; summer session. (Massey.)

P. E. 160. Theory of Exercise. (3)

First and second semesters; summer session. Prerequisite, P. E. 100. (Massey.)

P. E. 170. Supervision in Elementary School Physical Education. (3)

First and second semesters; summer session. Prerequisite, P. E. 120. (Humphrey.)

P. E. 180. Measurement in Physical Education and Health. (3)

First and second semesters; summer session. Two lectures and two laboratory periods a week. (Eyer, Mohr.)

P. E. 182. History of Dance. (3)

First semester. Prerequisites, P. E. 52, 54, 56, 58, or permission of instructor. (Madden.)

P. E. 184. Theory and Philosophy of Dance. (3)

First and second semesters. (Madden.)

P. E. 189. *Field Laboratory Projects and Workshop.* (1-6)

First and second semesters; summer session.

(Staff.)

P. E. 190. *Administration and Supervision of Physical Education, Recreation and Health.* (3)

First and second semesters; summer session.

(Johnson.)

P. E. 191. *The Curriculum in Elementary School Physical Education.* (3)

First and second semesters; summer session. Prerequisite, P. E. 120. (Humphrey.)

P. E. 195. *Organization and Administration of Elementary School Physical Education.* (3)

First and second semesters; summer session. Prerequisite, P. E. 120. (Humphrey.)

P. E. 196. *Quantitative Methods.* (3)

First and second semesters; summer session.

(Massey.)

For Graduates

P. E. 200. *Seminar in Physical Education, Recreation and Health.* (1)

First and second semesters; summer session.

(Staff.)

P. E. 201. *Foundations in Physical Education, Recreation and Health.* (3)

First and second semesters; summer session.

(Johnson, Eyler.)

P. E. 202. *Status and Trends in Elementary School Physical Education.* (3)

First and second semesters; summer session.

(Humphrey.)

P. E. 203. *Supervisory Techniques in Physical Education, Recreation and Health.* (3)

First and second semesters; summer session.

(Mohr.)

P. E. 204. *Physical Education and the Development of the Child.* (3)

First and second semesters; summer session. Three lectures a week. (Humphrey.)

P. E. 205. *Analysis of Contemporary Athletics.* (3)

First and second semesters; summer session.

(Eyler.)

P. E. 210. *Methods and Techniques of Research.* (3)

First and second semesters; summer session.

(Mohr.)

P. E. 215. *Principles and Techniques of Evaluation.* (3)

First and second semesters; summer session.

(Mohr.)

P. E. 230. *Source Material Survey.* (3)

First and second semesters; summer session.

(Eyler.)

P. E. 250. *Mental and Emotional Aspects of Sports and Recreation.* (3)

First and second semesters; summer session.

(Johnson.)

Physical Education, Recreation and Health

P. E. 280. The Scientific Bases of Exercise. (3)

First and second semesters; summer session.

(Massey.)

P. E. 287. Advanced Seminar. (1-2)

First and second semesters; summer session.

(Deach.)

P. E. 288. Special Problems in Physical Education, Recreation and Health. (1-6)

First and second semesters; summer session.

(Staff.)

P. E. 290. Administrative Direction of Physical Education, Recreation and Health. (3)

First and second semesters; summer session.

(Deach.)

P. E. 291. Curriculum Construction in Physical Education and Health. (3)

First and second semesters; summer session.

(Deach, Mohr.)

P. E. 399. Research. (1-5)

First and second semesters; summer session.

(Staff.)

B. HEALTH EDUCATION

For Graduates and Advanced Undergraduates

Hea. 150. Health Problems of Children and Youth. (3)

First and second semesters; summer session.

(Johnson.)

Hea. 160. Problems in School Health Education in Elementary and Secondary School. (2-6)

First and second semesters; summer session.

(Johnson, Staff.)

Hea. 170. The Health Program in the Elementary School. (3)

First and second semesters; summer session. Prerequisites, Hea. 2 and 4, or Hea. 40.
(Humphrey.)

Hea. 178. Fundamentals of Sex Education for Teachers. (3)

First and second semesters; summer session.

(Johnson.)

Hea. 180. Measurement in Physical Education and Health. (3)

First and second semesters; summer session.

(Eyler, Mohr.)

Hea. 189. Field Laboratory Projects and Workshop. (1-6)

First and second semesters; summer session.

(Staff.)

Hea. 190. Administration and Supervision of School Health Education. (3)

First and second semesters; summer session.

(Johnson.)

For Graduates

Hea. 200. Seminar in Physical Education, Recreation and Health. (1)

First and second semesters; summer session.

(Staff.)

- Hea. 203. Supervisory Techniques in Physical Education, Recreation and Health. (3)*
First and second semesters; summer session. (Mohr.)
- Hea. 210. Methods and Techniques of Research. (3)*
First and second semesters; summer session. (Mohr.)
- Hea. 220. Scientific Foundations of Health Education. (3)*
First and second semesters; summer session. (Johnson.)
- Hea. 230. Source Material Survey. (3)*
First and second semesters; summer session. (Eyler.)
- Hea. 240. Modern Theories of Health. (3)*
First and second semesters; summer session. (Johnson.)
- Hea. 250. Health Problems in Guidance. (3)*
First and second semesters; summer session. (Johnson.)
- Hea. 260. Public Health Education. (3)*
First and second semesters; summer session. (Johnson.)
- Hea. 280. Scientific Bases of Exercise. (3)*
First and second semesters; summer session. (Massey.)
- Hea. 287. Advanced Seminar. (1-2)*
First and second semesters; summer session. (Deach.)
- Hea. 288. Special Problems in Physical Education, Recreation and Health. (1-6)*
First and second semesters; summer session. (Staff.)
- Hea. 290. Administrative Direction of Physical Education, Recreation and Health. (3)*
First and second semesters; summer session. (Deach.)
- Hea. 291. Curriculum Construction in Physical Education and Health. (3)*
First and second semesters; summer session. (Mohr.)
- Hea. 399. Research. (1-5)*
First and second semesters; summer session. (Staff.)

C. RECREATION

For Graduates and Advanced Undergraduates

- Rec. 120. Program Planning. (3)*
First and second semesters. Prerequisite, Rec. 30. (Harvey.)

Physical Education, Recreation and Health

Rec. 150. Camp Management. (3)

First and second semesters; summer session.

(Harvey.)

Rec. 180. Leadership Techniques and Practices. (3)

First and second semesters.

(Harvey.)

Rec. S184. Outdoor Education. (6)

Summer only.

(Staff.)

Rec. 189. Field Laboratory Projects and Workshops. (1-6)

First and second semesters; summer session.

(Staff.)

Rec. 190. Organization and Administration of Recreation. (3)

First and second semesters.

(Harvey.)

Rec. 196. Quantitative Methods. (3)

First and second semesters; summer session.

(Massey.)

For Graduates

Rec. 200. Seminar in Physical Education, Recreation and Health. (1)

First and second semesters; summer session.

(Staff.)

Rec. 201. Foundations in Physical Education, Recreation and Health. (3)

First and second semesters; summer session.

(Johnson, Eyer.)

Rec. 202. Philosophy of Recreation. (2)

First and second semesters; summer session.

(Harvey.)

Rec. 203. Supervisory Techniques in Physical Education, Recreation and Health. (3)

First and second semesters; summer session.

(Mohr.)

Rec. 204. Modern Trends in Recreation. (3)

First and second semesters; summer session.

(Harvey.)

Rec. 210. Methods and Techniques of Research. (3)

First and second semesters; summer session.

(Mohr.)

Rec. 215. Principles and Techniques of Evaluation. (3)

First and second semesters; summer session.

(Mohr.)

Rec. 230. Source Material Survey. (3)

First and second semesters; summer session.

(Eyer.)

Rec. 240. Industrial Recreation. (3)

First and second semesters; summer session.

(Harvey.)

Rec. 260. Hospital Recreation. (3)

First and second semesters; summer session.

(Harvey.)

Rec. 287. *Advanced Seminar. (1-2)*

First and second semesters; summer session.

(Deach.)

Rec. 288. *Special Problems in Physical Education, Recreation and Health. (1-6)*

First and second semesters; summer session.

(Staff.)

Rec. 290. *Administrative Direction of Physical Education, Recreation and Health. (3)*

First and second semesters; summer session.

(Deach.)

Rec. 399. *Research. (1-5)*

First and second semesters; summer session.

(Staff.)

PHYSICS

Professors: TOLL, MORGAN AND MYERS.

Research Professors: BURGERS* AND MONTROLL*.

Visiting Research Professors: OPIK AND WESKE*.

Part-time Professors: DE LAUNAY, HERZFELD, KENNARD AND WANGSNES.

Associate Professors: ANDERSON, FERRELL, HORNYAK, ISKRAUT, SINGER AND SNOW.

Assistant Professors: LASTER, MACDONALD, MARION, STERN, SUCHER AND WEBBER.

Assistant Research Professors: GRIEM, HAMA*, HINNOV AND MARADUDIN.

Research Associates: DAY, LEVESQUE, ONEDA AND PAI.

Research Affiliate: BURGER.

Part-time Lecturers: AITKEN, ALLEN, BASS, FRIEDMAN, GREEN, HAYWARD, JACKSON, JASTROW, KAHN, LIDE, MARTON, OPPENHEIM, O'ROURKE, OVERTON, SHAPIRO, SLAWSKY, SNAVELY, F. STERN, WADA AND WOLCOTT.

It is expected that the following courses should have been taken preliminary to graduate work. Any deficiencies should be made up at once. A limited amount of graduate credit will be allowed for courses so taken.

General Physics

Heat

Intermediate Mechanics

Optics

Electricity and Magnetism

Modern Physics

Differential and Integral Calculus

Advanced Calculus

Candidates for both the master's and doctor's degrees are required to take Introduction to Theoretical Physics (Phys. 200, 201). The course runs for a full year and carries 12 semester hours credit. The minimum prerequisites in mathematics are differential and integral calculus, but advanced calculus, differential equations, and vector analysis are recommended.

Candidates for the doctor's degree should take both the Introduction to Theoretical Physics with Quantum Mechanics. No other courses are specifically required for students doing experimental thesis research, but Relativistic

*Member of the Institute for Fluid Dynamics and Applied Mathematics.

Quantum Mechanics is required for students doing dissertations in theoretical physics. It is recommended in the selection of further courses that the student avoid overspecialization in any field. In particular, he should take a wide variety of classical courses as well as courses in selected fields of modern physics. Some of the advanced courses are given only every second or third year; the student should check with the Physics Department to confirm when a given course is available.

Candidates for advanced degrees in physics may have a minor in either chemistry, mathematics, engineering, and/or in those fields of physics other than general physics and their field of major specialization.

Thesis (Ph.D.):

The student must outline his topic to the graduate staff for approval. This outline must clearly set forth the nature of the problem, proposed method of procedure and the possible results that may be obtained. The completed thesis will also be presented to the graduate staff for approval.

Off-Campus Courses:

The Physics Department offers courses at convenient times and places so as to accommodate the greatest number of students. In order to facilitate graduate study and supervision of research in the Washington area, the Department has part-time professors in certain government laboratories where a large number of students are interested in graduate study and where there are facilities for research. All students who began graduate work in the University of Maryland courses after 1954 will be required to complete on the College Park campus at least 18 credits of their graduate work for the Ph.D. degree in Physics: these credits must include at least 2 credits of Phys. 230, Seminar, and the remainder can be divided among major and minor courses and thesis research. Normally, students will complete a much greater proportion of their graduate study on the College Park campus. At government agencies where there is no part-time professor, employees desiring to do graduate work in physics should contact a member of the graduate staff in the Physics Department.

Further Information:

For more information, students should write the Physics Department for the departmental publication entitled "Graduate Study in Physics."

A. GENERAL PHYSICS

For Graduates and Advanced Undergraduates

Phys. 100. Advanced Experiments. (2 credits per semester)

Four hours of laboratory work per week. Prerequisite, four credits of Phys. 60 or

consent of instructor. Laboratory fee, \$10.00 per semester. Selected fundamental experiments in electricity and magnetism, elementary electronics, and optics.
(Marion.)

Phys. 102. Optics. (3)

Second semester. Three lectures a week. Prerequisites, Phys. 11 or 21; Math. 21. It is suggested, but not required, that Phys. 60 or Phys. 100 be taken concurrently with this course. Geometrical optics, optical instruments, wave motion, interference and diffraction, and other phenomena in physical optics.
(Hinnov.)

Phys. 103. Applied Optics. (3)

First semester. Three lectures a week. Prerequisite, Phys. 102. A detailed study of physical optics and its applications.
(Morgan.)

Phys. 104, 105. Electricity and Magnetism. (3, 3)

First and second semesters. Three lectures a week. Prerequisites, Phys. 11 or 21; Math. 21. Electrostatics, direct current and alternating current circuitry, electromagnetic effects of steady currents, electromagnetic induction, radiation, development of Maxwell's equations, Poynting vector, wave equations, and electronics.
(Griem.)

Phys. 106, 107. Theoretical Mechanics. (3, 3)

First and second semesters. Three lectures a week. Prerequisite, Phys. 51 or consent of instructor. A detailed study of Newtonian mechanics. Dynamics, the motion of rigid bodies, oscillation problems, etc., are studied. Lagrange's equation of the first kind and the Hamilton-Jacobi equation are introduced.
(Hama.)

Phys. 108. Physics of Electron Tubes. (3)

First semester. Three lectures a week. Prerequisite, Phys. 104 must be taken previously or concurrently. A study of the electromagnetic principles relevant to electron tubes and of their applications.
(Hornyak.)

Phys. 109. Electronic Circuits. (4)

Second semester. Four lectures a week. Prerequisite, Phys. 105 must be taken previously or concurrently. Theory of physics detectors and pulse circuits. Application in circuit design.
(Levesque.)

Phys. 110. Special Laboratory Projects in Physics. (1, 2, or 3)

Two hours laboratory work a week for each credit hour. One to three credits may be taken concurrently, each semester. Prerequisite, Phys. 100 and consent of advisor. Selected advanced experiments.
(Staff.)

Phys. 111. Physics Shop Techniques. (1)

First semester. One three-hour laboratory per week. Prerequisite, Phys. 100 or consent of instructor. Laboratory fee, \$10.00. Machine tools, design and construction of laboratory equipment.
(Horn.)

Phys. 114, 115. Introduction to Biophysics. (2, 2)

First and second semesters. Two lectures a week. Prerequisites, intermediate physics and Math. 21. A study of the physical principles involved in biological processes, with particular emphasis on current research in biophysics.
(Britten.)

Physics

Phys. 118. Introduction to Modern Physics. (3)

First semester. Three lectures a week. Prerequisites, general physics and integral calculus, with some knowledge of differential equations and a degree of maturity as evidenced by having taken one or more of the courses Phys. 50 through Phys. 110. Introductory discussion of special relativity, origin of quantum theory, Bohr atom, wave mechanics, atomic structure, and optical spectra. (Hornyak.)

Phys. 119. Modern Physics. (3)

Second semester. Three lectures a week. Prerequisite, Phys. 118. A survey of nuclear physics, x-rays, radioactivity, wave mechanics, and cosmic radiation. (Stern.)

Phys. 130, 131. Basic Concepts of Physics. (2, 2)

First and second semesters. Two lectures a week. Prerequisite, junior standing. Lecture demonstration fee, \$2.00 per semester. A primarily descriptive course intended mainly for those students in the liberal arts who have not had any other course in physics. This course does not satisfy the requirements of professional schools nor serve as a prerequisite or substitute for other physics courses. The main emphasis in the course will be on the concepts of physics, their evolution and their relation to other branches of human endeavor. (Laster.)

Phys. 140, 141. Atomic and Nuclear Physics Laboratory. (3, 3)

One lecture and four hours of laboratory a week. Prerequisites, two credits of Phys. 100 and consent of instructor. Classical experiments in atomic physics and more sophisticated experiments in current techniques in nuclear physics. Enrollment is limited to ten students. (Marion.)

For Graduates

Phys. 200, 201. Introduction to Theoretical Physics. (6, 6)

First and second semesters. Six lecture hours per week. Prerequisite, Phys. 106 or consent of instructor. This basic course for graduate study in physics covers advanced classical mechanics, electrodynamics, relativity, thermodynamics, and statistical mechanics. (Myers.)

Phys. 202, 203. Advanced Dynamics. (2, 2)

First and second semesters. Two lectures a week. Prerequisite, Phys. 200. A detailed study of advanced classical mechanics. (Myers.)

Phys. 204. Electrodynamics. (4)

Four lectures a week. Prerequisite, Phys. 201. A detailed study of advanced classical electrodynamics. (Iskraut.)

Phys. 206. Physical Optics. (3)

Three lectures a week. Prerequisite, Phys. 201. A detailed study of advanced physical optics. (Hinnov.)

Phys. 208. Thermodynamics. (3)

First semester. Three lectures per week. Prerequisite, Phys. 201. The first and second laws of thermodynamics are examined and applied to homogeneous and non-homogeneous systems, calculations of properties of matter, the derivation of equilibrium conditions and phase transitions, the theory of irreversible processes. (Schamp.)

Phys. 212, 213. Introduction to Quantum Mechanics. (4, 4)

First and second semesters. Four lectures per week. Prerequisite, Phys. 200 or an outstanding undergraduate background in physics. A study of the Schroedinger equation, matrix formulations of quantum mechanics, approximation methods, scattering theory, etc., and applications to solid state, atomic, and nuclear physics. (Ferrell.)

Phys. 222, 223. Boundary-Value Problems of Theoretical Physics. (2, 2)

Prerequisite, Phys. 201. (de Launay.)

Phys. 236. Theory of Relativity. (3)

Three lectures a week. Prerequisite, Phys. 200. A study of Einstein's special theory of relativity and some consequences, and a brief survey of the foundations of general relativity. (Iskraut.)

Phys. 240, 241. Theory of Sound and Vibrations. (3, 3)

Three lectures a week. Prerequisite, Phys. 201. A detailed study of acoustics and the theory of vibrations. (Snively.)

B. ATOMIC AND MOLECULAR PHYSICS*For Graduates and Advanced Undergraduates**Phys. 126. Kinetic Theory of Gases. (3)*

Three lectures a week. Prerequisites, Phys. 107 and Math. 21. Dynamics of gas particles, Maxwell-Boltzman distribution, diffusion, Brownian motion, etc. (Kennard.)

*For Graduates**Phys. 210. Statistical Mechanics. (3)*

Second semester. Three lectures a week. Prerequisites, Phys. 119, and Phys. 201. A study of the determination of microscopic behavior of matter from microscopic models. Microcanonical, canonical, and grand canonical models. Applications to solid state physics and the study of gases. (Montroll.)

Phys. 214. Theory of Atomic Spectra. (3)

First semester. Three lectures a week. Prerequisite, Phys. 213. A study of atomic spectra and structure—one and two electron spectra, fine and hyper-fine structure, line strengths, line widths, etc. (Anderson.)

Phys. 215. Theory of Molecular Spectra. (3)

Second semester. Three lectures a week. Prerequisite, Phys. 214. The structure and properties of molecules as revealed by rotational, vibrational, and electronic spectra. (Anderson.)

Physics

Phys. 216, 217. Molecular Physics. (2, 2)

Two lectures a week. Prerequisite, Phys. 213. Molecular theory of gases and liquids, ensemble theory, analysis of empirical models for molecular interactions, theory of Coulomb interactions between charge distributions. (Jansen.)

C. SOLID STATE PHYSICS

For Graduates and Advanced Undergraduates

Phys. 122. Properties of Matter. (4)

First semester. Four lectures a week. Prerequisite, Phys. 118 or equivalent. Thermal, elastic, and electromagnetic properties of solids. Characteristics of fluids, and high polymer physics. (Stern.)

For Graduates

Phys. 218, 219. X-Rays and Crystal Structure. (3, 3)

Three lectures per week. Prerequisite, Phys. 201. A detailed study of crystal structure of solids and of x-rays. (Morgan.)

Phys. 220. Application of X-Ray and Electron Diffraction Methods. (2)

Two laboratory periods a week. Prerequisite, concurrent enrollment in Phys. 218. The investigation of crystal structure, using x-rays and electron diffraction. (Morgan.)

Phys. 242, 243. Theory of Solids. (2, 2)

First and second semesters. Two lectures a week. Prerequisite, Phys. 213. Properties of metals, lattice vibrations and specific heats, Boltzmann, Fermi-Dirac, and Bose-Einstein statistics, free electron gas theories, band theory of metals. (Montroll.)

D. NUCLEAR PHYSICS

For Graduates and Advanced Undergraduates

Phys. 120. Nuclear Physics. (4)

Second semester. Four lectures a week. Prerequisite, Phys. 118 or equivalent. Shell model, liquid drop model, statistical model of nuclei, interaction of radiation and charged particles with matter, nuclear reactors, conservation laws, beta decay and other selected topics. (Hornyak.)

Phys. 121. Neutron Physics and Fission Reactors. (4)

Second semester. Four lectures a week. Prerequisite, Phys. 120. Neutron diffusion and reactor physics. (Shapiro.)

For Graduates

Phys. 234, 235. Theoretical Nuclear Physics. (3, 3)

Three lectures a week. Prerequisites, Phys. 120 and Phys. 213. Nuclear properties and reactions, nuclear forces, two, three, and four body problems, nuclear spectroscopy, beta-decay, and related topics. (MacDonald.)

E. ELEMENTARY PARTICLE PHYSICS

*For Graduates**Phys. 237. Relativistic Quantum Mechanics. (3)*

First semester. Three lectures a week. Prerequisite, Phys. 213. Classical field theory, Klein-Gordon and Dirac equations, invariance properties, second quantization, renormalization, and related topics. (Sucher.)

Phys. 239. Elementary Particles. (3)

Three lectures a week. Prerequisite, Phys. 237. Survey of elementary particles and their properties, quantum field theory, meson theory, weak interactions, possible extensions of elementary particle theory. (Toll.)

Phys. 260. High Energy Physics. (3)

Three lectures a week. Prerequisite, Phys. 237. Nuclear forces are studied by examining interactions at high energies. Meson physics, scattering processes, and detailed analysis of high energy experiments. (Snow.)

Phys. 258. Quantum Field Theory.

Second semester. Three lectures a week. Prerequisite, Phys. 237. S-matrix, Feynman diagrams, scattering theory, renormalization, conservation laws, dispersion relations, and recent non-perturbation approaches to field theory. (Sucher.)

F. ASTROPHYSICS AND GEOPHYSICS

*For Graduates and Advanced Undergraduates**Phys. 124. Introduction to Astrophysics and Geophysics. (3)*

First semester. Three lectures a week. Prerequisite, Phys. 118 or consent of instructor. Celestial mechanics, orbit theory, upper atmosphere physics, astronomical spectroscopy, motions of charged particles in the earth's magnetic field. (Opik.)

*For Graduates**Phys. 221. Upper Atmosphere and Cosmic Ray Physics. (2)*

Second semester. Two lectures a week. Prerequisite, Phys. 200 or consent of instructor. Structure of the atmosphere, rocket and satellite experiments, primary and secondary cosmic rays, origins of cosmic rays, geomagnetic theory. (Singer.)

G. FLUID DYNAMICS

*For Graduates and Advanced Undergraduates**Phys. 116, 117. Fundamental Hydrodynamics. (3, 3)*

Three lectures a week. Prerequisites, Phys. 106 and Math. 21. Kinematics of fluid flow, properties of incompressible fluids, complex variable methods of analysis, wave motions. (Hama.)

For Graduates

Phys. 224, 225. *Supersonic Aerodynamics and Compressible Flow.* (2, 2)
Two lectures a week. Prerequisite, Phys. 201. (Pai.)

Phys. 226, 227. *Theoretical Hydrodynamics.* (3, 3)
Three lectures a week. Prerequisite, Phys. 201. A detailed study of advanced fluid dynamics. (Burgers.)

Phys. 232, 233. *Hydromechanics Seminar.* (1, 1)
First and second semesters. One meeting a week. (Kennard.)

Phys. 246, 247. *Special Topics in Fluid Dynamics.* (2, 2)
Prerequisites, advanced graduate standing and consent of the instructor. (Burgers.)

Phys. 262, 263. *Aerophysics.* (3, 3)
Three lectures. Prerequisite, consent of the instructor. (Pai.)

H. RESEARCH, SEMINARS AND SPECIAL TOPICS

For Graduates and Advanced Undergraduates

Phys. 150. *Special Problems in Physics.*

Research or special study. Credit according to work done. Laboratory fee, \$10.00 per credit hour when appropriate. Given each semester. Prerequisite, major in physics and consent of advisor. (Staff.)

For Graduates

Phys. 230. *Seminar.*

Seminars on various topics in advanced physics are held each semester, with the contents varied each year. One credit for each seminar each semester. (Staff.)

Phys. 231. *Applied Physics Seminar.*

One credit for each semester. (Staff.)

Phys. 238. *Quantum Theory—Selected Topics.* (3)

Three lectures a week. Prerequisite, Phys. 237. (Staff.)

Phys. 245. *Special Topics in Applied Physics.*

2 credits each semester. Two lectures a week. (Staff.)

Phys. 248, 249. *Special Topics in Modern Physics.* (2, 2)

Two lectures a week. Prerequisites, calculus and consent of instructor. (Staff.)

Phys. 399. *Research.*

Credit according to work done, each semester. Laboratory fee, \$10.00 per credit hour. Prerequisite: an approved application for admission to candidacy or special permission of the Physics Department. (Staff.)

I. SPECIAL PHYSICS COURSES FOR HIGH SCHOOL SCIENCE TEACHERS

The courses in this section were especially designed for high school teachers and are not applicable to B.S., M.S. or Ph.D. degrees in Physics without special permission of the Physics Department. However, these courses can be included as part of a physics minor or as electives. No prerequisites are required.

Phys. 118A. Atoms, Nuclei, and Stars. (3)

Three lectures per week. An introduction to basic ideas of the constitution and properties of atomic and subatomic systems and of the overall structure of the universe. (Iskraut.)

Phys. 122A. Properties of Materials. (3)

Three lectures per week. An introduction to the study of solid state physics and the properties of fluids. (Maradudin.)

Phys. 160A. Physics Problems. (1, 2, 3)

Lectures and discussion sessions arranged. (Goodwin.)

Phys. 170A. Applied Physics. (3)

Three lectures per week. (Montroll.)

Phys. 199. National Science Foundation Summer Institute for Teachers of Science and Mathematics Seminar. (1)

Arranged during Summer School. Enrollment limited to participants in the N.S.F. Summer Institute. Laboratory fee, \$5.00. (Laster, Staff.)

POULTRY HUSBANDRY

Professors: SHAFFNER AND COMBS.

Research Professor: SHORB.

Assistant Professors: CREEK, HELBACKA AND WILCOX.

Course work and research leading to the Master of Science and the Doctor of Philosophy degrees are offered. The student may pursue work with the major emphasis either in nutrition, physiology, physiological genetics, or the technology of eggs and poultry.

Department requirements, supplementary to the Graduate School, have been formulated for the guidance of candidates for graduate degrees. Copies of these requirements may be obtained from the Department of Poultry Husbandry.

For Graduates and Advanced Undergraduates

P. H. 104. Technology of Market Eggs and Poultry. (3)

First semester, alternate years. (Not offered in 1959-1960.) Two lectures and one laboratory per week. A study of the technological factors concerned with the processing, storage, and marketing of eggs and poultry, also factors affecting their quality and grading. (Helbacka.)

Poultry Husbandry

A. E. 117. Economics of Marketing Eggs and Poultry. (3)

Second semester. Three lectures per week. (See Agricultural Economics A. E. 117.)

Poultry Hygiene, see Veterinary Science, V. S. 107.

Avian Anatomy, see Veterinary Science, V. S. 108.

P. H. S111. Poultry Breeding and Feeding. (1)

Summer session only. This course is designed primarily for teachers of vocational agriculture and extension service workers. The first half will be devoted to problems concerning breeding and the development of breeding stock. The second half will be devoted to nutrition. (Combs, Wilcox.)

P. H. S112. Poultry Products and Marketing. (1)

Summer session only. This course is designed primarily for teachers of vocational agriculture and county agents. It deals with the factors affecting the quality of poultry products and with hatchery management problems, egg and poultry grading, preservation problems and market outlets for Maryland poultry. (Helbacka.)

P. H. 198. Special Poultry Problems. (1-2)

First and second semesters. For senior poultry students. No more than three credits may be applied towards a graduate degree. The student will be assigned special problems in the field of poultry for individual study and report. The poultry staff should be consulted before any student registers for this course. (Staff.)

For Graduates

P. H. 201. Advanced Poultry Genetics. (3)

First semester. Prerequisites, P. H. 100 and Zool. 104, or equivalents. This course serves as a foundation for research in poultry genetics. Linkage, crossing-over, inheritance of sex, the expression of genes in development, inheritance of resistance to disease, and the influence of the environment on the expression of genetic capacities are considered. (Wilcox.)

P. H. 202. Advanced Poultry Nutrition. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisites, P. H. 101, Chem. 31, 32, 33 and 34 or permission of instructor. A fundamental study of the dietary role of proteins, minerals, vitamins, antibiotics, and carbohydrates is given as well as a study of the digestion and metabolism of these substances. Deficiency diseases as produced by the use of synthetic diets are considered. (Combs.)

P. H. 203. Physiology of Reproduction of Poultry. (3)

First semester. Two lectures and one laboratory period a week. Prerequisite, P. H. 102 or its equivalent. The role of the endocrines in avian reproduction, is considered. Fertility, sexual maturity, broodiness, egg formation, ovulation, and the physiology of oviposition are studied. Comparative mammalian functions are discussed. (Shaffner.)

P. H. 205. Poultry Literature. (1-4)

First and second semesters. Readings on individual topics are assigned. Written reports required. Methods of analysis and presentation of scientific material are discussed. (Staff.)

P. H. 207. Poultry Nutrition Laboratory. (2)

First semester, alternate years. One lecture and one laboratory period a week. (Not offered 1959-1960.) To acquaint graduate students with common basic nutrition research techniques useful in conducting experiments with poultry. Actual feeding trials with chicks, as well as bacteriological and chemical assays will be performed.

(Combs, Creek.)

P. H. 302. Poultry Seminar. (1)

First and second semesters. No more than two credits in Seminar may be applied towards a graduate degree. Oral reports of current researches by staff members, graduate students, and guest speakers are presented.

(Staff.)

P. H. 399. Research. (1-6)

First and second semesters. Credit in accordance with work done. Practical and fundamental research with poultry may be conducted under the supervision of staff members toward the requirements for the degrees of M.S. and Ph.D.

(Staff.)

PSYCHOLOGY

Professors: ANDREWS, COFER, GUSTAD AND ROSS.

Associate Professors: MCGINNIES, MAGOON AND SOLEM.

Assistant Professors: BRUSH, GONZALEZ, PUMROY AND WEGNER.

Lecturer: BRADY.

All graduate students who have deficiencies in their undergraduate preparation in psychology will be required to remove the particular deficiencies by completing the required courses or by individual study. Deficiencies in the following course areas can be removed only by registering in and satisfactorily completing these courses: Experimental Psychology, Statistical Methods, and Tests and Measurements.

Departmental requirements toward the Master of Arts or the Master of Science degrees: 20 hours in the following courses: Psych. 191-192, 198, 252-253, and 266-267; 6 hours of research (Psych. 399); a minimum of 8 hours in approved specialized courses; total 34 hours.

Departmental requirements toward the Doctor of Philosophy degree: 26 hours in the following courses: Psych. 191-192, 198, 203, 205-206, 252-253, 266-267; 18 hours of graduate research including 12 hours for Ph.D. Thesis; a minimum of 28 hours in approved specialized courses and research; total 72 hours.

For Graduates and Advanced Undergraduates

Graduate credit will be assigned only for students certified by the Department of Psychology as qualified for graduate standing.

Psych. 106. Statistical Methods in Psychology. (3)

First and second semesters. Prerequisites, Psych. 1 and Math. 1, 5, or 10, or equivalent. A basic introduction to quantitative methods used in psychological research; measures of central tendency, of spread, and of correlation.

(Brush, Pliskoff.)

Psychology

Psych. 110. Educational Psychology. (3)

Second semester. Prerequisite, Psych. 1. Researches on fundamental psychological problems encountered in education. Measurement and significance of individual differences; learning, motivation, transfer of training, and the educational implications of theories of intelligence. (Wegner, Pliskoff.)

Psych. 122. Advanced Social Psychology. (3)

Second semester. Prerequisites, Psych. 21 and consent of instructor. A systematic review of researches and points of view in regard to major problems in the field of social psychology. (McGinnies, Wegner.)

Psych. 123. Language and Social Communication. (3)

Second semester. Prerequisite, Psych. 21. The nature and significance of verbal and non-verbal communication in social psychological processes, including examination of relevant theoretical approaches to symbolic behavior. (Wegner.)

Psych. 128. Human Motivation. (3)

First and second semesters. Prerequisite, Psych. 21. Review of research literature dealing with determinants of human performance, together with consideration of the major theoretical contributions in this area. (Cofer.)

Psych. 131. Abnormal Psychology. (3)

First and second semesters. Prerequisite, 3 courses in psychology. The nature, diagnosis, etiology, and treatment of mental disorders. (Magoon, Pumroy, Rosen.)

Psych. 136. Applied Experimental Psychology. (3)

Second semester. Prerequisite, Psych. 1. A study of basic human factors involved in the design and operation of machinery and equipment. Organized for students in engineering, industrial psychology, and the biological sciences. (Ross.)

Psych. 140. Psychological Problems in Advertising. (3)

Second semester. Prerequisite, Psych. 1. Psychological problems that arise in connection with the production and testing of advertising; techniques employed in attacking these problems through research. (Gonzalez.)

Psych. 142. Techniques of Interrogation. (3)

First and second semesters. Prerequisite, Psych. 21. The interview, the questionnaire, and other methods of obtaining evidence on human attitudes and reactions, as viewed in the light of modern research evidence. (Gonzalez.)

Psych. 145. Introduction to Experimental Psychology. (4)

First and second semesters. Prerequisite, Psych. 106. Laboratory fee, \$4.00. Primarily for students who major or minor in psychology. A systematic survey of the laboratory methods and techniques as applied to human behavior. Emphasis is placed on individual and group participation in experiments, use of data, and preparation of reports. (Ross, Brush.)

Psych. 148. Psychology of Learning. (3)

First semester. Prerequisite, Psych. 145. Review and analysis of the major phenomena and theories of human and animal learning, including an introduction to the fields of problem solving, thinking and reasoning behavior. (Cofer, Brush.)

Psych. 150. Tests and Measurements. (3)

First and second semesters. Prerequisite, Psych. 106. Laboratory fee, \$4.00. Critical survey of measuring devices used in counseling, educational and industrial practice with an emphasis on the theory, development and standardization. Laboratory practice in the administration and interpretation of a variety of commonly used tests is provided. (Gustad, Magoon.)

Psych. 161. Industrial Psychology. (3)

Second semester. Prerequisite, 6 hours in psychology. A survey course, intended for those who plan to enter some phase of personnel work, but who do not plan to undertake graduate study. (Solem.)

Psych. 180. Physiological Psychology. (3)

Prerequisite, Psych. 145. An introduction to research on the physiological basis of human behavior, including considerations of sensory phenomena, motor coordination, emotion, drives, and the neurological basis of learning. (Ross, Brady.)

Psych. 181. Animal Behavior. (3)

(Same as Zool. 181). Second semester. Prerequisite, consent of instructor. A study of animal behavior, including considerations of social interactions, learning, sensory processes, motivation, and experimental methods, with a major emphasis on mammals. (Ross.)

Psych. 191, 192. Advanced General Psychology. (3, 3)

First and second semesters. Prerequisites, 15 hours of psychology including Psych. 145 and consent of instructor. A systematic review of the more fundamental investigations upon which modern psychology is based. Intended primarily for exceptional senior majors and for graduate students. (Ross, Cofer, Brush.)

Psych. 194. Independent Study in Psychology. (1-3)

First and second semesters. Prerequisite, written consent of individual faculty supervisor. Integrated reading under direction, leading to the preparation of an adequately documented report on a special topic. (Staff.)

Psych. 195. Minor Problems in Psychology. (1-3)

First and second semesters. Prerequisite, written consent of individual faculty supervisor. An individualized course designed to allow the student to pursue a specialized topic or research project under supervision. (Staff.)

Psych. 198. Proseminar: Professional Aspects of Psychological Science. (2)

Second semester. Prerequisite, consent of faculty advisor. Survey of professional problems in psychology, including considerations of contemporary developments, professional ethics, literature resources, formulation of critical research problems, and discussion of the major institutions requiring psychological services. (Staff.)

For Graduates

(All the following courses require consent of the instructor.)

Psych. 201. Sensory Processes. (3)

Second semester. Prerequisites, Psych. 180 and 191. A detailed analysis of sensory

Psychology

systems emphasizing human processes and including anatomical, physiological, and psychological considerations. (Ross.)

Psych. 202. Perception. (3)

First semester. Prerequisite, Psych. 191. Review of modern methods and results in the research areas of form and brightness perception, meaning and constancy phenomena, movement and depth, and the influences of attitudes and motivation on human perception. (Andrews.)

Psych. 203, 204. Graduate Seminar. (2, 2)

First and second semesters. Surveys of contemporary American and foreign research literature in specialized fields in psychology. (Staff.)

Psych. 205, 206. Historical Viewpoints and Current Theories in Psychology. (3, 3)

First and second semesters. Prerequisite, Psych. 192. A study of the philosophical and scientific background of modern psychology, together with a review of its major systematic viewpoints and issues. (Cofer.)

Psych. 207. Learning Theory. (3)

Second semester. Prerequisite, Psych. 192. Systematic survey of modern theories of learning, including those of Hull, Skinner, Tolman, and Spence, with emphasis on modern behavioral concepts. (Brush, Gonzalez.)

Psych. 208. Language and Thought. (3)

First semester. Prerequisite, Psych. 192. A study of thinking and language processes, as they have been investigated descriptively and experimentally in both normal and abnormal individuals. (Cofer.)

Psych. 220. Psychological Concepts in Mental Health. (3)

Second semester. Introduction to the problem of mental health and potential contributions of psychology to its solution. Examination of a variety of psychological principles and techniques with respect to their utility. Development of a conceptual framework for approaching mental health problem. (Gustad, Magoon, Rosen.)

Psych. 221. Seminar in Counseling Psychology. (3)

The seminar focuses attention upon the historical antecedents, definitional considerations, various theoretical orientations and their implications for training, service and research. The treatment process is treated in terms of client-expectations, relationship problems and in terms of observation, inference, hypothesis making, and hypothesis testing. Considerable attention is devoted to past and current research, investigations of the treatment process, its outcomes, and to needed research evidence. (Gustad, Magoon.)

Psych. 222. Seminar in Clinical Psychology. (3)

Prerequisites, Psych. 150, 220. This seminar deals more intensively with the theoretical orientation of various treatments and the research evidence regarding the evaluation of the treatment process and its outcome. (Rosen, Pumroy.)

Psych. 223. Diagnosis and Correction of Reading Difficulties. (3)

Second semester. Prerequisites, Psych. 150, 220. Consideration of the range of reading difficulties, their etiology, manifestations and the various methods of corrective

treatment employed in removing or alleviating the conditions. Opportunity for observation and limited field work will be provided as available to demonstrate the variations resulting from differences in ability, age, and educational level. (Staff.)

Psych. 224. Advanced Procedures in Clinical and Counseling Psychology. (3)
Analysis of diagnostic and therapeutic procedures, both group and individual, employed in remediation of normal and abnormal problems. Consideration of experimental and evaluative literature bearing on these. Examination of a variety of systematic approaches to remediation of mental health problems. (Staff.)

Psych. 225. Practicum in Counseling and Clinical Procedures. (1-3)
First and second semesters. Prerequisite, Psych. 220. The practicum sequence is designed to introduce and advance the student through several increasingly complex stages of the clinical assessment and assistance to clients, individually and in groups. Practicum work is done primarily on a small group basis with individual consultation and supervision as needed. (Gustad, Magoon.)

Psych. 228. Seminar in Student Personnel. (2)
(Same as Ed. 228.) First semester. Prerequisite, permission of instructor. The seminar is designed to acquaint the student with student personnel functions at the collegiate level. Attention is devoted to the historical antecedents of student personnel activities, the range of services, their functions, responsibilities, interrelationships and projected future status. Resource personnel presently engaged in student personnel services will participate as needed. (Byrne, Gustad, Magoon.)

Psych. 229. Advanced Industrial Psychology. (3)
First semester. Prerequisite, Psych. 161 or equivalent. A review of certain fundamental problems in industry and the psychological techniques for studying them. Included will be analyses of motivation and morale, personnel selection and evaluation, management problem solving, and situational behavior controls. (Solem, Gonzalez.)

Psych. 230. Determinants of Human Efficiency. (3)
Second semester. An advanced seminar dealing with the analysis of factors and variables which affect human performance and efficiency. (Ross.)

Psych. 231. Training Procedures in Industry. (3)
Second semester. Prerequisite, Psych. 148 or equivalent. A consideration of psychological principles and methods for improving job performance; skill development laboratory in application of methods and techniques is provided. (Solem.)

Psych. 232. Personnel Selection and Job Analysis. (3)
Second semester. Prerequisite, Psych. 161 or equivalent. Psychological measurement as applied to the analysis of job requirements and the development and use of performance criteria and predictors. (Solem, Gonzalez.)

Psych. 233. Social Organization in Industry. (3)
First semester. Prerequisite, Psych. 229 or equivalent. Analysis of management organizations as social structures, and the application of concepts and methods of social psychology to problems of conflict, cooperation, and leader-group relations. (Solem.)

Psychology

Psych. 240. Interview and Questionnaire Techniques. (3)

Second semester. Psychological concepts and methods in the use of interview, questionnaire, and inventory procedures for the measurement, prediction and alteration of behavior. (Gonzalez.)

Psych. 241. Mass Communication and Persuasion. (3)

Second semester. Consideration of the communication process and the various media of mass communication. Factors related to the effectiveness of communications are analyzed in the light of experimental evidence, and various strategies and techniques of persuasion are reviewed. (McGinnies.)

Psych. 242. Seminar in Social Psychology. (3)

Second semester. Analysis and discussion of contemporary systematic positions in social psychology. Review of research methods in the area as well as theories and problems of current importance. (McGinnies.)

Psych. 250. Mental Test Theory. (3)

First semester. Prerequisite, Psych. 253. Development of test theory from psychophysics and measurement theory. Consideration of formal and applied problems involved in developing and utilizing psychological tests and measurements. Special attention is given to problems of reliability, validity, and prediction. (Gustad.)

Psych. 251. Development of Predictors. (3)

First semester. Prerequisite, Psych. 253. Review of statistical theory and practices in the design, development and analysis of techniques of prediction in the behavioral sciences, with special attention to the formal and practical problem of criteria for prediction. (Andrews.)

Psych. 252, 253. Advanced Statistics. (3, 3)

First and second semesters. Prerequisite, Psych. 106. Detailed study of the fundamentals of statistical inference, experimental design, and the analysis of regression and correlation concepts and techniques; a basic course for research students in the behavioral sciences. (Andrews, Brush.)

Psych. 254. Factor Analysis. (3)

First semester. Prerequisite, Psych. 253. Analysis of major developments in factor theory as applicable to the behavioral sciences, including computational methods and research implications. (Andrews.)

Psych. 255. Seminar in Psychometric Theory. (3)

Prerequisite, Psych. 253. Study of psychophysical methods, scaling techniques, and the statistical methods of pattern analysis. (Andrews.)

Psych. 260. Individual Tests. (3)

Prerequisite, Psych. 150. Laboratory fee, \$4.00. Analysis of the various theories of intelligence and current research in the area; practical experience in the administration, scoring and interpretation of currently used intelligence tests. (Magoon, Pumroy.)

Psych. 262. Appraisal of Personality. (3)

Prerequisite, Psych. 150. Evaluation of the normal individual by use of a variety of psychological tests and techniques, the objective being a broader and deeper understanding of the individual along as many dimensions as possible. (Pumroy.)

Psych. 264. Projective Tests. (3)

Second semester. Prerequisite, Psych. 260. Laboratory fee, \$4.00. A familiarization with currently used projective tests, including the theory, historical background, and research in the area. The student receives experience in administration, scoring and interpreting currently used projective tests, as well as some experience in writing psychological reports. (Pumroy.)

Psych. 265. Advanced Development Psychology. (3)

Detailed examination of empirical, experimental, and theoretical literature related to developmental processes from birth throughout life. Included are discussion of physical, social, intellectual, and emotional development at various life stages. Emphasis on developmental approach to understanding of personality. (Rosen.)

Psych. 266, 267. Theories of Personality and Motivation. (3, 3)

First and second semesters. Prerequisite, Psych. 128. A review of the experimental analyses and conceptual aspects of biological and acquired drives and motives, and a study of the use of motivational and other concepts in personality theories. (Cofer.)

Psych. 270. Advanced Abnormal Psychology. (3)

Prerequisite, Psych. 131. Extensive and intensive analyses of deviant human behavior, with emphasis on the theoretical concepts proposed by Freud, Jung, Adler, Rank, Horney, French and Alexander, Meyer, and Sullivan, as well as upon the contribution of the self-concept and neo-behavioral theorists. (Gustad, Rosen.)

Psych. 271. Special Testing of Disabilities. (3)

Second semester. Prerequisite, Psych. 260. Study of a variety of the lesser known psychological tests and techniques useful in evaluating individuals with certain disabilities, including cerebral palsy, speech problems, brain damage. (Magoon.)

Psych. 272, 273. Individual Clinical Diagnosis. (3, 3)

Prerequisite, Psych. 264. Study of emotionally disturbed individuals with a variety of psychological tests and techniques, including the use of intensive case study methodology; the aim being to understand the individual as thoroughly as possible, as well as the evaluation for the implications for treatment. (Gustad, Rosen.)

Psych. 280. Advanced Psychophysiology. (3)

First semester. An advanced seminar dealing with special selected topics in the area of psychophysiology. (Andrews, Ross, Brady.)

Psych. 288, 289. Special Research Problems. (1-3)

First and second semesters. Supervised research on problems selected from the areas of experimental, industrial, social, quantitative, or mental health psychology. (Staff.)

Psych. 399. Research. (credit arranged).

First and second semesters. (Staff.)

SOCIOLOGY

Professors: HOFFSOMMER AND LEJINS.

Associate Professors: MELVIN AND SHANKWEILER.

Assistant Professors: ANDERSON, COATES, CUSSLER AND ROHRER.

The Department of Sociology grants the degrees of Master of Arts and Doctor of Philosophy. Fields of specialization include Anthropology, Criminology, Rural and Urban Sociology, Mental Health, The Family, Industrial Sociology, Social Theory, Social Psychology and Research Methods.

Prerequisites for graduate study leading to an advanced degree with a major in sociology consist of either (1) an undergraduate major (totalling at least 24 semester hours) in sociology or (2) 12 semester hours of sociology (including 6 semester hours of advanced courses) and 12 additional hours of comparable work in economics, political science, or psychology. Reasonable substitutes for these prerequisites may be accepted in the case of students majoring in other departments who desire a graduate minor or several courses in sociology.

For Graduates and Advanced Undergraduates

Soc. 102. Intercultural Sociology. (3)

First semester. Prerequisite, Soc. 2. On the basis of a comparative study of customs, individual and group behavior patterns and institutions, this course studies the ideologies of America and other modern societies. The analysis of focuses on the nature of the social processes and group behavior of various peoples having or not having a written language. (Melvin.)

Soc. 105. Cultural Anthropology. (3)

Second semester; summer session (2). A survey of the simpler cultures of the world, with attention to historical processes and the application of anthropological theory to the modern situation. (Anderson.)

Soc. 106. Archeology. (3)

Second semester. A survey of human cultural developments as revealed by archeological methods, with materials to be drawn from selected areas of both Old and New Worlds. (Anderson.)

Soc. 112. Rural-Urban Relations. (3)

First semester; summer session (2). The ecology of population and the forces making for change in rural and urban life; migration, decentralization and regionalism as methods of studying individual and national issues. Applied field problems. (Cussler.)

Soc. 113. The Rural Community. (3)

Second semester. Prerequisite, Soc. 1, or its equivalent. A detailed study of rural life with emphasis on levels of living, the family, school, and church and organizational activities in the fields of health, recreation, welfare, and planning. (Hoffsommer, Fitzgerald.)

Soc. 114. The City. (3)

First semester; summer session (2). Prerequisite, Soc. 1, or its equivalent. The rise of urban civilization and metropolitan regions; ecological process and structure; the city as a center of dominance; social problems, control and planning. (Schmidt.)

Soc. 115. Industrial Sociology. (3)

First and second semesters; summer session (2). Prerequisite, Soc. 2, or its equivalent. The sociology of human relations in American industry and business. Complex industrial and business organizations as social systems. Social relationships within and between industry, business, community, and society. (Coates.)

Soc. 116. Military Sociology. (3)

First and second semesters. Prerequisite, Soc. 2. The sociology of military life. Social change and the growth of military institutions. Complex formal military organizations. Military organizations as social systems. Military service as an occupation or profession. Career patterns, problems and satisfactions. Relations between military institutions, civilian communities and society. (Coates.)

Soc. 118. Community Organization. (3)

First semester; summer session (2). Prerequisite, Soc. 1, or its equivalent. Community organization and its relation to social welfare; analysis of community needs and resources; health, housing, recreation; community centers; neighborhood projects. (DiBella, McElhenie.)

Soc. 121. Population. (3)

First semester; summer session (2). Prerequisite, Soc. 1 or its equivalent. Population distribution and growth in the United States and the world; population problems and policies. (Hirzel.)

Soc. 122. Population. (3)

Second semester. Prerequisite, Soc. 1 or its equivalent. Trends in fertility and mortality, migrations, population estimates and the resulting problems and policies. (Hirzel.)

Soc. 123. Ethnic Minorities. (3)

First semester; summer session (2). Prerequisite, Soc. 1, or its equivalent. Basic social processes in the relations of ethnic groups within the State; immigration groups and the Negro in the United States; ethnic minorities in Europe. (Lejins.)

Soc. 124. The Culture of the American Indian. (3)

Second semester. Prerequisite, Soc. 1, or its equivalent. A study of type cultures; cultural processes; and the effects of acculturation on selected tribes of Indians in the Americas. (Anderson.)

Soc. 125. Cultural History of the Negro. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. The cultures of Africa south of the Sahara and the cultural adjustments of the Negro in North and South America. (Anderson.)

Soc. 131. Introduction to Social Service. (3)

First and second semesters. General survey of the field of social-welfare activities; historical development; growth, functions, and specialization of agencies and services, private and public. (DiBella.)

Soc. 136. Sociology of Religion. (3)

First semester; summer session (2). Prerequisite, Soc. 1, or equivalent. Varieties and sources of religious experience. Religious institutions and the role of religion in social life. (Anderson.)

Soc. 141. Sociology of Personality. (3)

First semester; summer session (2). Prerequisite, Soc. 1, or its equivalent. Development of human nature and personality in contemporary social life; processes of socialization; attitudes, individual differences, and social behavior. (Motz, Cussler, Schmidt.)

Soc. 144. Collective Behavior. (3)

Second semester. Prerequisite, Soc. 1, or its equivalent. Social interaction in mass behavior; communication processes; structure and functioning of crowds, strikes, audiences, mass movements, and the public. (Cussler.)

Soc. 145. Social Control. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Forms, mechanisms, and techniques of group influence on human behavior; problems of social control in contemporary society. (Motz.)

Soc. 147. Sociology of Law. (3)

First semester. Prerequisite, Soc. 1, or its equivalent. Law as a form of social control; interrelation between legal and other conduct norms as to their content, sanctions, and methods of securing conformity; law as an integral part of the culture of the group; factors and processes operative in the formation of legal norms as determinants of human behavior. (Lejins.)

Soc. 153. Juvenile Delinquency. (3)

First semester; summer session (2). Prerequisite, Soc. 1, or its equivalent. Juvenile delinquency in relation to the general problem of crime; analysis of factors underlying juvenile delinquency; treatment and prevention. (Lejins.)

Soc. 154. Crime and Delinquency Prevention. (3)

Second semester. Prerequisites, Soc. 1, or its equivalent; Soc. 52, Soc. 153, or consent of instructor. (Offered in alternate years with Soc. 156.) Mobilization of community resources for the prevention of crime and delinquency; area programs and projects. (Lejins.)

Soc. 156. Institutional Treatment of Criminals and Delinquents. (3)

Second semester; summer session (2). Prerequisites, Soc. 1, or its equivalent; Soc. 52, Soc. 153, or consent of instructor. (Offered in alternate years with Soc. 154.) Organization and functions of penal and correctional institutions for adults and juveniles. (Lejins.)

Soc. 160. Interviewing in Social Work. (1½)

Summer session only.

(DiBella, McElhenie.)

Soc. 161. The Sociology of War. (3)

First semester; summer session (2). The origin and development of armed forces as institutions; the social causes, operations and results of war as social conflict; the relations of peace and war and revolution in contemporary civilization. (Coates.)

Soc. 162. Basic Principles and Current Practice in Public Welfare. (3)
Summer session only. (DiBella, McElhenie.)

Soc. 163. Attitude and Behavior Problems in Public School Work. (1½)
Summer session only. (DiBella, McElhenie.)

Soc. 164. The Family and Society. (3)
Second semester; summer session (2). Prerequisites, Soc. 1 and Soc. 64 or equivalent. Study of the family as a social institution; its biological and cultural foundations, historic development, changing structure and function; the interactions of marriage and parenthood, disorganizing and reorganizing factors in present day trends. (Shankweiler.)

Soc. 171. Family and Child Welfare. (3)
First semester; summer session (2). Prerequisite, Soc. 1, or its equivalent. Programs of family and child welfare agencies; social services to families and children; child placement; foster families. (DiBella.)

Soc. 173. Social Security. (3)
First semester. Prerequisite, Soc. 1, or its equivalent. The social security program in the United States; public assistance; social insurance. (DiBella.)

Soc. 174. Public Welfare. (3)
Second semester. Prerequisite, Soc. 1, or its equivalent. Development and organization of the public welfare movement in the United States, social legislation interrelations of Federal, State, and local agencies and institutions. (DiBella.)

Soc. 180. Small Group Analysis. (3)
First semester. Prerequisite, Soc. 1, or its equivalent. Analysis of small group structure and dynamics. Review of research on small groups in factories, military service, schools and communities. Presentation of techniques used in the study of small groups. (Franz.)

Soc. 183. Social Statistics. (3)
First and second semesters. Prerequisite, Soc. 1, or its equivalent. Measures of central tendency and dispersion, use of statistical inference in simple testing of null hypotheses, chi square, and labor saving computational devices for correlation. (Schmidt.)

Soc. 185. Advanced Social Statistics. (3)
Second semester. Prerequisite, Soc. 183, or equivalent. Provides refined statistical research methods for advanced students in the social sciences. Sampling theory, specialized correlation technique, advanced tests of significance, and other procedures. (Schmidt.)

Soc. 186. Sociological Theory. (3)
First and second semesters. Prerequisite, Soc. 1, or its equivalent. Development of the science of sociology; historical backgrounds; recent theories of society. (Melvin.)

Soc. 191. Social Field Training. (1-3)
First and second semesters. Prerequisites: For social work field training, Soc. 131; for crime control field training, Soc. 52 and 153. Enrollment restricted to available placements. Supervised field training in public and private social agencies. The

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student will select his particular area of interest and be responsible to an agency for a definite program of in-service training. Group meetings, individual conferences and written program reports will be a required part of the course. (Lejins, DiBella.)

Soc. 196. *Senior Seminar.* (3)

Second semester. Required of and open only to senior majors in sociology. Scope, fields, and research methods of sociology; practical applications of sociological knowledge. Individual study and reports. (Hoffsommer.)

For Graduates

Soc. 201. *Methods of Social Research.* (3)

First semester. Selection and formulation of research projects; methods and techniques of sociological investigation and analysis. Required of graduate majors in sociology. (Hoffsommer.)

Soc. 215. *Community Studies.* (3)

First semester. Intensive study of the factors affecting community development and growth, social structure, social stratification, social mobility and social institutions; analysis of particular communities. (Fitzgerald, Coates.)

Soc. 216. *Sociology of Occupations and Professions.* (3)

First semester. An analysis of the occupational and professional structure of American society, with special emphasis on changing roles, functions, ideologies and community-relationships. (Coates.)

Soc. 221. *Population and Society.* (3)

Second semester. Selected problems in the field of population; quantitative and qualitative aspects; American and world problems. (Hirzel.)

Soc. 224. *Race and Culture.* (3)

Second semester. Race and culture in contemporary society; mobility and the social effects of race and culture contacts and intermixture. (Anderson.)

Soc. 230. *Comparative Sociology.* (3)

Second semester. Comparison of the social institutions, organizations, patterns of collective behavior, and art manifestations of societal values of various countries. (Melvin.)

Soc. 241. *Personality and Social Structure.* (3)

Second semester. Comparative analysis of the development of human nature, personality, and social traits in select social structures. (Cussler.)

Soc. 246. *Public Opinion and Propaganda.* (3)

Second semester. Processes involved in the formation of mass attitudes; agencies and techniques of communication; quantitative measurement of public opinion. (Motz.)

Soc. 253. *Advanced Criminology.* (3)

First semester. Survey of the principal issues in contemporary criminological theory and research. (Lejins.)

Soc. 254. *Seminar: Criminology.* (3)

Second semester. Selected problems in criminology. (Lejins.)

Soc. 255. *Seminar: Juvenile Delinquency.* (3)

First semester. Selected problems in the field of juvenile delinquency. (Lejins.)

Soc. 256. *Crime and Delinquency as a Community Problem.* (3)

Second semester. An intensive study of selected problems in adult crime and juvenile delinquency in Maryland. (Lejins.)

Soc. 257. *Social Change and Social Policy.* (3)

First semester. Emergence and development of social policy as related to social change; policy-making factors in social welfare and social legislation. (Melvin.)

Soc. 262. *Family Studies.* (3)

Second semester. Case studies of family situations; statistical studies of family trends, methods of investigation and analysis. (Shankweiler.)

Soc. 263. *Marriage and Family Counseling.* (3)

Second semester. Prerequisites, Soc. 64 or Soc. 164 or consent of instructor. A sociological analysis of an emerging, family-centered profession: its interdisciplinary development and professional organization: its basic methods of coordinating art and science in solving family problems. Designed for advanced sociology majors or allied fields for use in vocations such as teaching, medicine, the ministry and others embodying the role of guidance. (Shankweiler.)

Soc. 264. *The Sociology of Mental Health.* (3)

First semester. A study of the sociological factors that condition mental health together with an appraisal of the group dynamics of its preservation. (Melvin.)

Soc. 282. *Sociological Methodology.* (3)

Second semester. Logic and method of sociology in relation to the general theory of scientific method; principal issues and points of view. (Staff.)

Soc. 285. *Seminar: Sociological Theory.* (3)

First semester. Critical and comparative study of contemporary European and American theories of society. (Melvin.)

Soc. 291. *Special Social Problems.* (Credit to be determined)

First and second semesters. Individual research on selected problems. (Staff.)

Soc. 399. *Research.* (Credit to be determined)

First and second semesters. (Staff.)

SPEECH AND DRAMATIC ART

Professor: HENDRICKS.

Associate Professor: STRAUSBAUGH.

Lecturer: SHUTTS.

The Department offers work leading to the Master of Arts degree in the field of Speech and Hearing Science.

For Graduates and Advanced Undergraduates

Sp. 102. Radio Production. (3)

Second semester. Prerequisite, Sp. 22. Laboratory fee, \$2.00. A study of the multiple problems facing the producer. Special emphasis is given to acoustic setup, casting, "miking," timing, cutting, and the coordination of personnel factors involved in the production of radio programs. (Batka.)

Sp. 103, 104. Speech Composition and Rhetoric. (3, 3)

First and second semesters. A study of rhetorical principles and models of speech composition in conjunction with the preparation and presentation of specific forms of public address. (Staff.)

Sp. 105. Speech—Handicapped School Children. (3)

Second semester. Prerequisite, Sp. 3 for undergraduates. The occurrence, identification and treatment of speech handicaps in the classroom. An introduction to speech pathology. (Craven and Staff.)

Sp. 106. Clinical Practice. (1 to 5 credits, up to 9)

Each semester; summer session. Prerequisite, Sp. 105. Laboratory fee, \$1.00 per hour. Clinical practice in various methods of corrective procedures with various types of speech cases in the University Clinic, veterans hospitals, and the public schools. May be taken for 1-5 credit hours per semester. May be repeated for a total of 9 semester hours credit. (Conlon.)

Sp. 107. Advanced Oral Interpretation. (3)

Second semester. Prerequisite, Sp. 13. Emphasis upon the longer reading. Program planning. (Provensen.)

Sp. 109. Speech and Language Development of Children. (3)

Second semester. Admission by consent of instructor. An analysis of normal and abnormal processes of speech and language development in children. (Hendricks.)

Sp. 110. Advanced Group Discussion. (3)

First and second semesters. Prerequisite, Sp. 10. Required in Speech curriculum and elective in other curricula. An examination of current research and techniques in the discussion and conference including extensive practice in this area. (Linkow.)

Sp. 111. Seminar. (3)

First and second semesters. Prerequisites, senior standing and consent of instructor. Required of speech majors. Present-day speech research. (Strausbaugh.)

Sp. 112. Phonetics. (3)

First semester. Prerequisite, Sp. 3 or consent of instructor. Laboratory fee, \$3.00. Training in the recognition and production of the sounds of spoken English, with an analysis of their formation. Practice in transcription. Mastery of the International Phonetic Alphabet. (Conlon.)

Sp. 113. Play Production. (3)

Second semester. Prerequisite, Sp. 16 or consent of instructor. Development of procedure followed by the director in preparing plays for public performance. (Pugliese.)

Sp. 114. The Film as an Art Form. (3)

First and second semesters. Laboratory fee, \$7.50. A study of the motion picture as a developing form of entertainment, communication, and artistic expression. A series of significant American and foreign films are viewed to illustrate the artistic, historical and sociological trends of the twentieth century. (Niemeyer.)

Sp. 115. Radio in Retailing. (3)

First semester. Limited to students in the College of Home Economics. Prerequisite, Sp. 1 or 7. Laboratory fee, \$2.00. Writing and production of promotional programs for the merchandising of wearing apparel and house furnishings. Collaboration with Washington and Baltimore radio stations and retail stores. (Batka.)

Sp. 116. Radio Announcing. (3)

Second semester. Prerequisites, Sp. 4 and 22 or consent of instructor. Laboratory fee, \$2.00. The theory and application of all types of announcing. (Batka.)

Sp. 117. Radio and Television Continuity Writing. (3)

First semester. Prerequisite, Sp. 22 or consent of instructor. A study of the principles, methods and limitations of writing for radio and television. Application will be made in the writing of general types of continuities and commercials. (Aylward.)

Sp. 119. Radio Acting. (3)

Second semester. Prerequisite, Sp. 22. A workshop course designed to give the student practice in radio acting. (Pugliese.)

Sp. 120. Speech Pathology. (3)

First semester. Prerequisite, Sp. 105. Laboratory fee, \$3.00. A continuation of Sp. 105, with emphasis on the causes and treatment of organic speech disorders. (Hendricks.)

Sp. 122. Radio Workshop. (3)

First semester. Prerequisite, Sp. 102 or 116. Laboratory fee, \$2.00. A laboratory course dealing with all phases of producing a radio program. (Batka.)

Sp. 126. Semantic Aspects of Speech in Human Relations. (3)

Second semester. Prerequisite, one course in public speaking. An analysis of speech and language habits from the standpoint of general semantics. (Hendricks.)

Sp. 129, 130. Play Directing. (3, 3)

Admission by consent of instructor. A lecture-laboratory course dealing with the fundamentals of script cutting, pacing, movement, blocking, and rehearsal routine as applied to the directing of plays. (Niemeyer.)

Sp. 131. History of the Theatre. (3)

First semester. A survey of dramatic production from early origins to 1800. (Niemeyer.)

Sp. 132. History of the Theatre. (3)

Second semester. A survey of dramatic production from 1800 to present. (Niemeyer.)

Sp. 133. Communication Processes in Conferences. (3)

Second semester. Prerequisite, Sp. 103 and 104 or the equivalent. Limited to students in the Military Studies curriculum. Group participation in conferences, methods of

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problem solving, semantic aspects of language and the function of conferences in industry and government. (Linkow.)

Sp. 135. Instrumentation in Speech and Hearing Science. (2)

First semester. Prerequisite, Sp. 3. Laboratory fee, \$2.00. The use of electronic equipment in the measurement of speech and hearing. (Linkow.)

Sp. 136. Principles of Speech Therapy. (3)

Prerequisite, Sp. 120. Laboratory fee, \$3.00. Differential diagnosis of speech and language handicaps and the application of psychological principles of learning, motivation and adjustment in the treatment of speech disorders. (Hendricks.)

Sp. 138. Methods and Materials in Speech Correction. (3)

Prerequisite, Sp. 120 or the equivalent. Laboratory fee, \$3.00. The design and use of methods and materials for diagnosis, measurement, and retraining of the speech-handicapped. (Craven.)

Sp. 139. Theatre Workshop. (3)

First and second semesters. Prerequisite, Sp. 8 or Sp. 14. A laboratory course designed to provide the student with practical experience in all phases of theatre production. (Strausbaugh.)

Sp. 140. Principles of Television Production. (3)

First semester. Prerequisite, Sp. 22. A study of the theory, methods, techniques and problems of television production and direction. Units of study covering television cameras and lenses, lighting theory and practices, scenery and properties, costumes and makeup, graphic arts and special effects, are included. Observation of production procedures at nearby television stations. Application will be made through crew assignments for University-produced television programs. (Batka.)

Sp. 141. Introduction to Audiometry. (2)

First semester. Prerequisite, Sp. 3. Required for students whose concentration is in Speech and Hearing Therapy. Laboratory fee, \$2.00. Analysis of various methods and procedures in evaluating hearing losses. (Craven.)

Sp. 142. Speech Reading and Auditory Training. (2)

Second semester. Prerequisite, Sp. 3. Required for students whose concentration is in Speech and Hearing Therapy. Laboratory fee, \$2.00. Methods of training individuals with hearing loss to recognize, interpret, and understand spoken language. (Conlon.)

Sp. 146. Television News and Public Affairs. (3)

Second semester. Prerequisite, Sp. 117 or Journ. 101. Training in presentation of television news, interviews, discussions and forums. (Batka and Staff.)

Sp. 147. Analysis of Broadcasting Processes and Results. (2)

First semester. Prerequisite, Sp. 22 or consent of instructor. Survey of the more common analytic approaches, methods, and results in the field of radio and television. (Batka and Staff.)

Sp. 148. Television Direction. (3)

First semester. Prerequisite, Sp. 22 or Sp. 140. Laboratory fee, \$10.00. Principles of

television direction including analysis of script, casting, rehearsing, production, and video control. Two hour lecture, three hour laboratory. (Batka and Staff.)

Sp. 149. Television Workshop. (3)

Second semester. Prerequisites, Sp. 22, 140 or 148, or consent of instructor. Laboratory fee, \$10.00. Advanced laboratory course dealing with all phases of producing a complete television program. Two hour lecture, four hour laboratory. (Batka and Staff.)

Sp. 150. Radio and Television Station Management. (2)

Second semester. Prerequisite, Sp. 22 or consent of instructor. Broadcasting regulations, licenses, personnel functions, sales, advertising, and program and station promotion. (Batka and Staff.)

For Graduates

(All the following courses require consent of instructor.)

The Department maintains a reciprocal agreement with Walter Reed General Hospital whereby clinical practice may be obtained at the Army Audiology and Speech Correction Center, Forest Glen, Maryland, under the direction of James P. Albrite, M.D., Director.

Sp. 201. Special Problems Seminar. (A through K) (1-3)

(6 hours applicable toward M.A. degree.) Prerequisites, 6 hours of speech pathology and consent of instructor. A. stuttering; B. cleft palate; C. delayed speech; D. articulation; E. cerebral palsy; F. voice; G. special problems of the deaf; H. foreign dialect; I. speech intelligibility; J. neurophysiology of hearing; K. minor research problems. (Hendricks and Staff.)

Sp. 202. Techniques of Research in Speech and Hearing. (3)

First semester. Prerequisite, 12 hours of speech pathology and audiology. Required of candidates for master's degree in Speech and Hearing Therapy. Analysis of research methodology including experimental techniques, statistical analysis and preparation of reports for scientific investigations in speech and hearing science. (Williams.)

Sp. 203. Experimental Phonetics. (3)

Prerequisite, Sp. 112. Laboratory fee, \$3.00. The application of experimental methods in the quantitative analysis of the phonetic elements of speech. (Hendricks.)

Sp. 210. Anatomy and Physiology of Speech and Hearing. (3)

Prerequisite, 6 hours of speech pathology and audiology and consent of instructor. Laboratory fee, \$3.00. A study of the anatomy and physiology of the auditory and speech mechanisms. (Gerlach.)

Sp. 211. A, B, C, D. Advanced Clinical Practice. (1-3 up to 12)

(6 hours applicable toward M.A. degree.) Prerequisite, 12 hours of speech pathology and audiology. Laboratory fee, \$1.00 per hour. Supervised training in the application of clinical methods in the diagnosis and treatment of speech and hearing disorders. (Craven.)

Sp. 212. Advanced Speech Pathology. (3)

Second semester. Prerequisites, 6 hours in speech pathology and consent of instructor. Laboratory fee, \$3.00. Etiology and therapy for organic and functional speech disorders. (Lore.)

Sp. 214. Clinical Audiometry. (3)

First semester. Prerequisites, 3 hours in audiology and consent of instructor. Laboratory fee, \$3.00. Testing of auditory acuity with pure tones and speech. (Shutts.)

Sp. 216. Communication Skills for the Hard-of-Hearing. (3)

First semester. Prerequisites, 3 hours in audiology and consent of instructor. Speech reading, auditory training, and speech conservation problems in the rehabilitation of the hard-of-hearing. (Causey.)

Sp. 217. Selection of Prosthetic Appliances for the Acoustically Handicapped. (3)

Second semester. Prerequisite, Sp. 214. Laboratory fee, \$3.00. A laboratory course in modern methods of utilizing electronic hearing aids. (Shutts.)

Sp. 218. Speech and Hearing in Medical Rehabilitation and Special Education Programs. (3)

Second semester. Prerequisites, 6 hours in speech pathology and audiology and consent of instructor. Administrative problems involved in the organization and operation of speech and hearing therapy under different types of programs. (Hendricks.)

Sp. 219. Speech Disorders of the Brain-Injured. (3)

Prerequisites, 6 hours in pathology and audiology and consent of instructor. Laboratory fee, \$3.00. Methods of evaluation and treatment of children and adults who have suffered injury to brain tissue, with subsequent damage to speech and language processes. (Hendricks.)

Sp. 220. Experimental Audiology. (3)

Second semester. Prerequisite, 6 hours in audiology. Laboratory fee, \$3.00. A study of experimental techniques in the investigation of problems in audiology and psychoacoustics. (Hendricks and Staff.)

Sp. 221. Communication Theory and Speech and Hearing Problems. (3)

Second semester. Prerequisites, 6 hours in speech pathology and audiology and consent of instructor. Analysis of current theories of communication as they apply to research and therapy in speech and hearing. (Hendricks.)

Sp. 399. Research. (3-6)

Credit in proportion to work done and results accomplished. (Hendricks.)

VETERINARY SCIENCE

Professor: HANSEN.

No advanced degrees are given in the Department of Veterinary Science. Graduate students in other departments are accepted for problems in the Depart

ment of Veterinary Science upon approval of the department in which the graduate degree may be given.

For Graduates and Advanced Undergraduates

V. S. 101. Comparative Anatomy. (3)

First semester. Two lectures and one laboratory period a week. Normal structure of the domesticated animals; normal physiological activities; interrelationship of structure and function. (Sperry.)

V. S. 102. Animal Hygiene. (3)

Second semester. Two lectures and one laboratory period a week. Nature of disease; immunity; prevention and control; common diseases of farm animals. (Sperry.)

V. S. 107. Poultry Hygiene. (3)

Second semester. Two lectures and one laboratory period a week. Prerequisites, Microb. 1, P. H. 1. Virus, bacterial, and protozoon diseases; parasitic diseases; prevention, control, and eradication. (De Volt.)

V. S. 108. Avian Anatomy and Physiology. (3)

First semester. Two lectures and one laboratory a week. Prerequisite, Zool. 1. Gross and microscopic structure, physiological processes; dissection and demonstration. (De Volt.)

For Graduates

V. S. 203. Electron Microscopy. (2)

First semester. One lecture and one laboratory period a week. Theory of the electron microscope, preparation of specimens, manipulations, photography. (Reagan and Byrne.)

V. S. 399. Animal Disease Research. (2-6)

First and second semesters. Credit in accordance with work done. Prerequisite, veterinary degree or consent of staff. Studies of practical disease phases. (Poelma, DeVolt, Hansen, Byrne, Brueckner.)

ZOOLOGY

Professors: WHARTON, ANASTOS AND SCHOENBORN.

Associate Professors: BROWN AND WINN.

Assistant Professors: GROLLMAN, HALEY, HIGHTON AND RAMM.

The Department of Zoology offers work leading to the Master of Science and the Doctor of Philosophy degrees. The general academic requirements which must be fulfilled for these degrees are described earlier in the catalog.

The special fields which graduate students may emphasize in working toward these degrees are cytology, ecology, embryology, fisheries, parasitology,

Zoology

physiology, and systematics. Information concerning the specific requirements in each of these fields may be obtained from the Department.

Alternate year courses will be offered according to the following schedule: (a) courses offered in 1959-60, not offered in 1960-61; (b) courses not offered in 1959-60, offered in 1960-61.

All zoology courses with laboratory have a laboratory fee of \$8.00 per course per semester.

For Graduates and Advanced Undergraduates

Zool. 102. General Animal Physiology. (4)

Second semester; occasional summer session. Two lectures and two three-hour laboratory periods a week. Prerequisites, one year of zoology and one year of chemistry. (Schoenborn.)

Zool. 104. Genetics. (3)

First semester; summer session. Two lectures and one discussion period a week. Prerequisite, one course of zoology or botany. (Highton.)

Zool. 108. Animal Histology. (4)

Second semester; occasional summer session. Two lectures and two three-hour laboratory periods a week. Prerequisite, one year of zoology. (Brown.)

Zool. 110. Parasitology. (4)

First semester; occasional summer session. Two lectures and two two-hour laboratory periods a week. Prerequisite, one year of zoology. (Haley.)

Zool. 111. Veterinary Parasitology. (4)

Second semester. Two lectures and two two-hour laboratory periods a week. Prerequisite, Zool. 110. Alternate years (a). (Haley.)

Zool. 112. Wildlife Parasitology. (4)

Second semester. Two lectures and two two-hour laboratory periods a week. Prerequisite, Zool. 110. Alternate years (b). (Haley.)

Zool. 118. Invertebrate Zoology. (4)

First semester; occasional summer session. Two lectures and two three-hour laboratory periods a week. Prerequisite, one year of zoology. (Staff.)

Zool. 121. Principles of Animal Ecology. (3)

Second semester; occasional summer session. Two lectures and one three-hour laboratory period a week. Prerequisites, one year of zoology and one year of chemistry. (Staff.)

Zool. 125. Fisheries Biology and Management. (3)

First semester. Two lectures and one three-hour laboratory period a week. Prerequisites, Zool. 1 and 2 or equivalent. Alternate years (a). (Staff.)

Zoology

Zool. 126. *Shellfisheries*. (3)

Second semester. Two lectures and one three-hour laboratory period a week. Prerequisite, Zool. 2 or equivalent. Alternate years (b). (Staff.)

Zool. 127. *Ichthyology*. (4)

Second semester. Two lectures, one two-hour and one three-hour laboratory periods a week. Prerequisites, Zool. 5 and 20. Alternate years (b). (Winn.)

Zool. 128. *Zoogeography*. (4)

First semester. Two lectures and two two-hour laboratory periods a week. Prerequisite, one year of zoology, botany, or geology. Alternate years (b). (Staff.)

Zool. 181. *Animal Behavior*. (3)

(Same as Psych. 181.) Second semester. Three lectures a week. Prerequisite, permission of the instructor. Alternate years (a). (Ross.)

Zool. 199S. *National Science Foundation Summer Institute for Teachers of Science and Mathematics. Seminar*. (1)

Summer school. Seminar fee, \$5.00. (Brown and Staff.)

For Graduates

Zool. 200. *Marine Zoology*. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Alternate years (a). (Staff.)

Zool. 202. *Animal Cytology*. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Prerequisite, Zool. 108. Alternate years (b). (Brown.)

Zool. 203. *Advanced Embryology*. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Prerequisite, Zool. 20. Alternate years (a). (Ramm.)

Zool. 204. *Advanced Physiology*. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Prerequisites, Zool. 102 and one year of organic chemistry. (Schoenborn.)

Zool. 205. *Limnology*. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Alternate years (a). (Staff.)

Zool. 207. *Zoology Seminar*. (Credit to be arranged)

First and second semesters; summer session. One lecture a week for each credit hour. A. cytology; B. embryology; C. fisheries; D. genetics; E. parasitology; F. physiology; G. systematics; H. ecology; I. behavior; and S. recent advances. (Staff.)

Zool. 208. *Special Problems in Zoology*. (Credit to be arranged)

First and second semesters; summer session. A. cytology; B. embryology; C. fisheries;

Zoology

E. parasitology; F. physiology; G. systematics; H. ecology; and I. behavior. (Staff.)

Zool. 209. *Advanced Parasitology*. (4)

First semester. Three lectures and one three-hour laboratory period a week. Prerequisite, Zool. 110 or permission of the instructor. Alternate years (b). (Anastos.)

Zool. 210. *Systematic Zoology*. (4)

Second semester. Three lectures and one three-hour laboratory period a week. Alternate years (b). (Highton.)

Zool. 211, 212. *Lectures in Zoology*. (3, 3)

First and second semesters. Three lectures a week. (Visiting Lecturers.)

Zool. 215S. *Fisheries Technology*. (4)

To be offered as needed during the summer session at the Sea Food Processing Laboratory, Crisfield, Maryland. Two lectures and two three-hour laboratory periods a week. (Staff.)

Zool. 216. *Physiological Cytology*. (4)

First semester. Two lectures and two three-hour laboratory periods a week. Prerequisites, Chem. 161, 162, Phys. 11, and Zool. 102, or permission of the instructor. Alternate years (a). (Brown.)

Zool. 220. *Advanced Genetics*. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Prerequisite, Zool. 104. Alternate years (a). (Highton.)

Zool. 223. *Analysis of Animal Structure*. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Alternate years (b). (Ramm.)

Zool. 231S. *Acarology*. (3)

Summer session. Lecture and laboratory. (Camin.)

Zool. 232S. *Medical and Veterinary Acarology*. (3)

Summer session. Lecture and laboratory. (Strandtmann.)

Zool. 233S. *Agricultural Acarology*. (3)

Summer session. Lecture and laboratory. (Baker.)

Zool. 234. *Experimental Mammalian Physiology*. (4)

First semester. Two four-hour laboratory periods a week. Prerequisites, Zool. 102 and one year of chemistry above general chemistry. (Grollman.)

Zool. 235. *Comparative Behavior*. (4)

Second semester. Two lectures and two three-hour laboratory periods a week. Prerequisites, Zool. 121 and 181, or permission of the instructor. Alternate years (a). (Winn.)

Zool. 399. *Research*. (Credit to be arranged)

First and second semesters; summer session. Work on thesis project only. A. cytology; B. embryology; C. fisheries; E. parasitology; F. physiology; G. systematics; H. ecology; and I. behavior. (Staff.)

SCHOOL OF DENTISTRY

ANATOMY

Professor: HAHN.

Associate Professor: THOMPSON.

Lecturer: LINDENBERG.

*For Graduates and Advanced Undergraduates**Anat. 111. Human Gross Anatomy. (8)*

First semester. Two lectures and three laboratories a week. Second semester. Two lectures and two laboratory periods for eight weeks. This course consists of dissections and lectures supplemented by frequent conferences and practical demonstrations. The entire human body is dissected. The subject is taught with the purpose of emphasizing the principles of the body structure, the knowledge of which is derived from a study of its development, its organs and tissues and the action of its parts. (Hahn, Thompson.)

Anat. 112. Human Neuroanatomy. (2)

Second semester. Two lectures and two laboratory periods for eight weeks. Prerequisite, Anat. 111 or equivalent. The work consists of a study of the brain and spinal cord by gross dissections and microscopic methods. Correlation is made, whenever possible, with the student's work in the histology and physiology of the central nervous system. (Hahn, Thompson, Lindenberg.)

*For Graduates**Anat. 211. Human Gross Anatomy. (8)*

Same as Anat. 111 but with additional work on a more advanced level.

Anat. 212. Human Neuroanatomy. (2)

Same as Anat. 112 but with additional instruction of a more advanced nature.

(Hahn, Thompson, Lindenberg.)

Anat. 214. The Anatomy of the Head and Neck. (3)

One conference and two laboratory periods per week for one semester. This course is designed to provide the student with a detailed study of the basic anatomy of the region and to correlate this knowledge with the various aspects of clinical practice. (Hahn, Thompson.)

Anat. 399. Research.

(Credit determined by amount and quality of work performed.)

(Staff.)

BIOCHEMISTRY

Professor: VANDEN BOSCHE.

*For Graduates and Advanced Undergraduates**Biochem. 111. Principles of Biochemistry. (6)*

First year. Prerequisites, inorganic and organic chemistry, with additional training in

Dentistry

quantitative and physical chemistry desirable. Two lectures and one laboratory period throughout the year. (Vanden Bosche.)

For Graduates

Biochem. 211. Advanced Biochemistry. (6)

Prerequisite, Biochem. 111. Two lectures, one conference and one laboratory period throughout the year. (Vanden Bosche.)

Biochem. 399. Research.

(Number of hours and credit by arrangement.)

(Vanden Bosche.)

HISTOLOGY

Professor: PROVENZA.

Hist. 111. Mammalian Histology and Embryology. (8)

First year. The course embraces the thorough study of the cells, tissues and organs of the various systems of the human body. Although certain aspects of the dental histology phase of the course are given strictly as special entities, many are included in the instruction in general histology, since the two areas are so intimately related when functional and clinical applications are considered. The instruction in embryology is correlated with that in histology. It covers the fundamentals of development of the human body, particular emphasis being given to the head and facial regions, the oral cavity, and the teeth and their adnexa. Specific correlations are also made with the other courses in the dental curriculum.

For Graduates

Hist. 212. Mammalian Histology and Embryology. (6)

This course is the same as Hist. 111, except that it does not include the dental phases of 111, but does include additional instruction and collateral reading of an advanced nature.

Hist. 213. Mammalian Oral Histology and Embryology. (2)

Prerequisite, Hist. 111 or 212, or an equivalent course. This course covers the dental aspects of Hist. 111, and includes additional instruction in the relations of histologic structure and embryologic development of the teeth, their adnexa, and the head and facial regions of the human body.

Hist. 399. Research.

(Number of hours and credit by arrangement.)

MICROBIOLOGY

Professor: SHAY.

For Graduates and Advanced Undergraduates

Microb. 115. Serology and Immunology. (4)

Second semester. Two lectures and two laboratory periods a week. Protective reactions

of the animal body against pathogenic microorganisms and their products; cellular and humoral immunity; anaphylaxis and allergies.

Microb. 121. Dental Microbiology and Immunology. (4)

First semester. Consideration is given to pathogenic bacteria, viruses, yeasts and molds. Special attention is given to those organisms which produce lesions of the oral cavity. Immunological principles are studied with emphasis on hypersensitivity resulting from antibiotics, antigens and vaccines. Laboratory teaching includes cultural characteristics, disinfection, sterilization, asepsis, animal inoculation, antibiotics assay and virus techniques. In all phases of the course emphasis is placed on dental applications.

For Graduates

Microb. 200, 201. Chemotherapy. (1, 1)

Offered in alternate years. Prerequisites, Microb. 121 or equivalent, Biochem. 111 or equivalent. Lectures which deal with the chemistry, toxicity, pharmacology and therapeutic value of drugs employed in the treatment of disease.

Microb. 202, 203. Reagents and Media. (1, 1)

Offered in alternate years. Consideration of media for special procedures, such as, antibiotic assays, blood cultures, spinal fluid, exudates and other materials. Anaerobiosis, differential media, biochemical reactions, sensitivity and sterility testing are considered in detail. Emphasis is placed on growth requirements of specific groups of microorganisms.

Microb. 210. Special Problems in Microbiology.

Laboratory course. Special studies in the various divisions of microbiology. Credit determined by amount and quality of work performed.

Microb. 211. Public Health. (2)

Prerequisite, Microb. 121 or equivalent. A demonstration of public health facilities in the community and their relation to the practices of the health sciences carried on through lectures and discussion groups. The application of statistical and epidemiological methods to health problems is illustrated through lectures and demonstration.

Microb. 399. Thesis Research.

(Credit determined by amount and quality of work performed.) Open only to candidates for advanced degrees in microbiology.

ORAL SURGERY

Professor: DORSEY.

Associate Professor: CAPPUCCIO.

For Graduates

Surg. 201. Clinical Anesthesiology. (6)

Forty hours a week for thirteen weeks.

(Heldrich, Staff.)

Dentistry

Surg. 220. *General Dental Oral Surgery.* (4)

Two lectures and two laboratory periods a week for one semester. (Dorsey, Staff.)

Surg. 221. *Advanced Oral Surgery.* (4)

Two lectures and two laboratory periods a week for one semester. (Dorsey, Staff.)

Surg. 399. *Research.*

Time and credit by arrangement. (Staff.)

PATHOLOGY

Professor: M. AISENBERG.

For Graduates and Advanced Undergraduates

Path. 121. *General Pathology.* (4)

Two lectures and two laboratory periods per week for one semester. (Aisenberg.)

For Graduates

Path. 211. *Advanced Oral Pathology.* (8)

Two lectures and two laboratory periods throughout the year. This course is presented with the objective of correlating a knowledge of histopathology with the various aspects of clinical practice. Studies of surgical and biopsy specimens are stressed. (Aisenberg.)

Path. 399. *Research.*

Time and credit by arrangement. (Aisenberg.)

PHYSIOLOGY

Professor: OSTER.

Associate Professors: SHIPLEY AND POLLACK.

For Graduates and Advanced Undergraduates

Physiology 121. *Principles of Physiology.* (6)

Second year. 132 hours. Three lectures and one laboratory period in first semester, two lectures in second semester. The study of the functions of major mammalian organ systems is coordinated with basic cellular neural and hormonal physiology in relation to the integrated activity of the human body.

(Oster, Shipley, Pollack, Staling.)

Physiology 211. *Principles of Mammalian Physiology.* (6)

Prerequisite, permission from the Department. Same as Physiology 121 but with collateral reading and additional instruction. Each student is required to write a review paper on some special phase of physiology. (Staff.)

Physiology 212. Advanced Physiology.

Hours and credit by arrangement. Prerequisite, Physiology 121 or its equivalent. Lectures and seminars on special problems and recent advances in physiology during the second semester. (Staff.)

Physiology 213. Research.

By arrangement with the Head of the Department. (Staff.)

Physiology 399. Thesis Research.

By arrangement with the Head of the Department. (Staff.)

SCHOOL OF MEDICINE

ANATOMY

Professors: FIGGE AND NAUTA.

Research Professor: UHLENHUTH.

Associate Professors: KRAHL AND MACK.

Assistant Professor: LEVEQUE.

The graduate degrees offered by the Department of Anatomy are the Master of Science and the Doctor of Philosophy.

A. ANATOMY

For Graduates and Advanced Undergraduates

Anat. 101. Human Gross Anatomy. (8)

Four conferences or lectures, 12 laboratory hours per week throughout the first semester. Laboratory fee, \$25.00. This course gives the student an opportunity to develop a basic concept of the morphology of the human body. It is closely interwoven with the study of neuroanatomy, histology and embryology, and some time is devoted to roentgen anatomy. The entire human body is dissected.

(Figge, Krahl, Mack, Leveque, Mech, McCafferty, Saunders.)

Anat. 103. Practical Anatomy. (4)

Second semester. Laboratory fee, \$20.00. Two lectures and two two-hour laboratories per week for 16 weeks. This course is designed to bridge the gap between abstract anatomy and clinical anatomy as applied to the study and practice of medicine and surgery. It will be required of all majors in Anatomy. The study of surface anatomy will be correlated with physical diagnosis. (Brantigan, Staff.)

For Graduates

Anat. 201. General Anatomy of the Human Body. (8)

Same course as Anat. 101, but on a more advanced level. It can be taken by graduate

Medicine

as well as post-graduate students. Laboratory fee, \$25.00. (Figge, Staff.)

Anat. 202. The Anatomy of the Human Pelvis. (2)

Fifteen periods of four hours each, mornings by arrangement. This course is open to graduate students, medical students, and post-graduate students. (Uhlenhuth.)

Anat. 203. Clinical Anatomy. (4)

Same course as Anat. 103 but on a more advanced level. Laboratory fee, \$20.00. (Brantigan, Staff.)

Anat. 204. Fetal and Infant Anatomy. (2)

First semester. Laboratory fee, \$10.00. Fifteen periods of three hours each, every Thursday from 2 to 5 p.m. for 15 weeks. This course is open to graduate students and post-graduates interested in pediatrics. (Krahl.)

Anat. 399. Research in Anatomy.

Maximum credits, 12 per semester. Research work may be taken in any one of the branches of anatomy. (Figge, Staff.)

B. NEURO-ANATOMY

For Graduates and Advanced Undergraduates

Neuroanat. 101. Human Neuro-Anatomy. (4)

First semester. Two lectures and four laboratory hours per week for 16 weeks. Laboratory fee, \$15.00. The study of the detailed anatomy of the central nervous system is coordinated with structure and function of the entire nervous system. The dissection of the human brain and the examination of stained microscopic sections of various levels of the brain stem are required. (Figge, Nauta, Kuypers.)

For Graduates

Neuroanat. 201. Human Neuro-Anatomy. (4)

Same course as Neuroanat. 101, but with additional work of a more advanced nature. Laboratory fee, \$15.00. (Figge, Nauta, Kuypers.)

Neuroanat. 399. Research in Neuro-Anatomy.

Maximum credits, 12. Research work involving the central or peripheral nervous system. (Figge, Nauta, Kuypers, Leveque.)

C. MICRO-ANATOMY

For Graduates and Advanced Undergraduates

Microanat. 101. Mammalian Histology. (6)

First semester. Three lectures and six laboratory hours a week for 16 weeks. Laboratory fee, \$15.00. This course presents an integrated study of the histology and embryology of the human body. An attempt is made to correlate this with gross anatomy as well as other subjects in the medical curriculum. Special emphasis is

placed on the dynamic and functional aspects of the subject. (Figge, Mack, Leveque.)

For Graduates

Microanat. 201. Mammalian Histology. (6)

Same course as Microanat. 101, but with additional work of a more advanced nature. Laboratory fee, \$15.00. (Figge, Mack, Leveque.)

Microanat. 202. Normal and Atypical Growth. (2)

Lectures in problems of growth. Two hours per week, time to be arranged. Sixteen weeks, second semester. (Figge.)

Microanat. 399. Research.

Maximum credits, 12. Research work may be taken in any one of the branches which form the subject of Micro-Anatomy (including cancer research).

(Figge, Mack, Leveque.)

MICROBIOLOGY

Professor: WISSEMAN.

Associate Professor: SMITH.

Assistant Professors: SNYDER AND SWEET.

The Department of Microbiology offers the degree of Doctor of Philosophy. While the degree of Master of Science may be offered in special instances, priority for research facilities will be given aspirants to the Ph.D. degree. This Department encourages students who wish to enroll in the combined M.D.-Ph.D. program.

Emphasis is placed upon medical aspects of microbiology. Research programs are available in virology, rickettsiology, medical bacteriology and mycology, microbial physiology and bacterial cytology. Opportunities are open for experience in teaching and in diagnostic bacteriology and serology.

For Graduates and Advanced Undergraduates

Microb. 101. Medical Microbiology and Immunology. (8)

First semester. Four lecture hours and eight hours in laboratory and group conferences per week. Laboratory fee, \$10.00. This course begins with an introduction to basic principles of microbiology and immunology and then proceeds to consider the major groups of bacteria, spirochetes, fungi, rickettsiae and viruses that cause human disease. Emphasis is placed upon an analysis of the properties of microorganisms thought to be important in disease production, pathogenesis of infection and interaction with host defense mechanisms, epidemiology and control measures.

(Wisseman, Staff.)

For Graduates

Microb. 201. Medical Microbiology and Immunology. (8)

First semester. Four lecture hours and eight hours in laboratory and group conferences per week. Laboratory fee, \$10.00. This course, intended for the serious advanced

Interdepartmental Courses

student of medical microbiology, is built upon the framework of Microb. 101 supplemented with advanced readings and laboratory work. (Wissemann, Staff.)

Microb. 203. Microbial Physiology. (3)

Second semester, alternate years. Three lectures per week supplemented with demonstrations. By consent of instructor. This course surveys the metabolic processes of bacteria, fungi, rickettsiae, viruses and parasitic protozoa. (Myers, Wissemann.)

Microb. 205. Cytology and Genetics of Microorganisms. (2)

Second semester, alternate years. One lecture and one laboratory per week. Laboratory fee, \$10.00. Registration by consent of instructor. The structure of microorganisms will be studied by various means, including the electron microscope, in a sequence leading to the ultimate analysis of the nucleus, which, in turn, will be related to the genetics of the cell and its capabilities for mutation. The recognition, origin and importance of bacterial, viral and fungal mutants will be considered. (Smith, Staff.)

Microb. 206, 207. Seminar. (1, 1)

First and second semesters. One session per week. Graduate students, staff and guests participate in comprehensive and critical reviews of subjects of special interest or pertinent to graduate training program. (Wissemann, Staff.)

Microb. 208. Medical Mycology. (2)

Second semester, alternate years. One lecture and one laboratory per week. Laboratory fee, \$10.00. Registration by consent of instructor. Consists of a review of the fundamentals of elementary mycology; a consideration of methods for the isolation, cultivation and identification of actinomycetes, yeasts and fungi; and a study of the etiological agents and of the immunology, epidemiology, prognosis and treatment of the medical mycoses. (Smith.)

Microb. 209. Special Topics.

(Permission and credit arranged individually.) This course provides the opportunity for the graduate student to pursue under supervision subjects of special interest not offered in other formal courses. A study program is worked out with the instructor prior to registration and may consist of special readings, conferences, reports and, on occasion, laboratory experience. (Wissemann, Staff.)

Microb. 399. Research.

Maximum credits, 12 hours per semester.

(Wissemann, Staff.)

INTERDEPARTMENTAL COURSES

ID. 101. Man and His Environment. (2)

Distinguished leaders in American medicine participate in the presentation of these weekly sessions. The course is broad in scope, stressing the cultural aspects of anthropology with emphasis directed toward the sociological, psychological, physiological, and genealogical relationships of man and his surroundings. All departments of the School of Medicine participate. One-hour lecture and one-hour panel discussion Saturday mornings from 9 to 11 a.m. throughout the year.

BIOLOGICAL CHEMISTRY

Associate Professor: HERBST AND RUDOLPH.

Assistant Professor: EMERY.

Lecturer: SUMMERSON.

Graduate degrees offered by the Department of Biological Chemistry are the Master of Science and Doctor of Philosophy.

For Graduates and Advanced Undergraduates

Biochem. 101. Principles of Biochemistry. (8)

Second semester. Seven lectures and conferences and two three-hour laboratory periods a week. Prerequisites, inorganic, organic and quantitative or physical chemistry. Laboratory fee, \$20.00. Studies of the composition of living organisms and the chemical and physical processes which occur during health and in disease.

(Staff.)

For Graduates

Biochem. 201. Principles of Biochemistry. (8)

Same course as Biochem. 101 with additional assignments in biochemical literature. Laboratory fee, \$20.00.

(Staff.)

Biochem. 202. Special Topics in Biochemistry. (1, 1)

Prerequisite, Biochem. 101 or 201. Reading assignments and written summaries of the classical research literature in biochemistry.

(Herbst.)

Biochem. 204, 205. Seminar. (1, 1)

First and second semesters. Reports on the current literature or on research in progress.

(Herbst.)

Biochem. 206. Enzymes and Metabolism. (3)

First semester. Three lectures per week on enzyme kinetics and intermediary metabolism. Prerequisite, Biochem. 201.

(Herbst, Rudolph.)

Biochem. 207. Enzymes and Metabolism Laboratory. (3)

First semester. Three three-hour laboratory periods per week on radioactive tracer methods, cell fractionation, enzyme preparation and assay procedures. To be taken concurrently with Biochem. 206.

(Rudolph, Herbst, Emery.)

Biochem. 208. Biochemical Preparations. (1-4)

Credit according to work assigned. The preparation of biochemicals by methods illustrating useful techniques for the isolation and purification of natural products.

(Herbst, Rudolph, Emery.)

Interdepartmental Courses

Biochem. 399. *Research.*

Maximum credits, 12 hours per semester.

(Herbst, Rudolph, Emery.)

LEGAL MEDICINE

Professor: FISHER.

Associate Professors: FREIMUTH AND LOVITT.

Leg. Med. 201. Legal Medicine. (1)

One hour of lecture for twelve weeks, 4 hours assigned reading. This course embraces a summary of medical jurisprudence including the laws governing the practice of medicine, industrial compensation and malpractice, proceedings in criminal and civil prosecution, medical evidence and testimony, including medicolegal toxicology. (12 hours).
(Fisher, Lovitt, Freimuth.)

Leg. Med. 202. Toxicology. (10)

Two hours lecture, 8 laboratory hours per week for 1 year. There is also included some discussion of industrial toxicology relating industrial exposures to toxic substances to effects produced in the worker using these materials. The lectures include discussion of mechanism of action of poisons, lethal doses, antidotes and methods of detection and quantitation of poisons in tissues and body fluids. The laboratory work embraces practical application of analytical procedures for the detection and estimation of poisons in post mortem tissue samples.
(Freimuth, Fisher.)

Leg. Med. 203. Gross Pathologic Anatomy as Related to Toxicology. (2)

Two hours per week for one year. This course includes elementary anatomy with normal histology and selected histopathology as it will be seen by the toxicologist. It is a correlated course embracing anatomy, basic physiology and the alterations in function as well as structure brought about by disease and poisoning. (Fisher, Lovitt.)

Leg. Med. 399. Research in Toxicology.

(Number of hours and credit arranged.)

(Freimuth, Fisher.)

This Department offers schedules leading to the degrees of Master of Science and Doctor of Philosophy in Toxicology. Candidates are expected to have completed undergraduate work as follows: Eight semester hours each in general chemistry, organic chemistry, analytical chemistry (qualitative and quantitative) physical chemistry, physics, biology and four semester hours in organic qualitative analysis.

Candidates for the Master's Degree must complete the following or equivalent courses:

Leg. Med. 201, 202, 203 and 399.

Pharm. 101, f. s., and Chem. 258.

Candidates for the doctorate must complete the following or equivalent courses:

Leg. Med. 201, 202, 203, 399.

Pharm. 100, f. s., Physiol. 102, Bact. 101, Bact. 102, Biochem. 206, Chem. 206, 208, Chem. 221, 223, Chem. 258, Chem. 150, Pharm. Chem. 111, 113, Pharm. Chem. 112, 114.

Part of the above work is offered at College Park with the remainder to be done at the Baltimore Schools. Some of the course work in Legal Medicine and Toxicology will be given at the Laboratories of the Division of Legal Medicine located at the Office of the Chief Medical Examiner, 700 Fleet Street, Baltimore, Maryland.

PHARMACOLOGY

Professor: KRANTZ.

Associate Professors: BURGISON AND TRUITT.

All students majoring in the Department of Pharmacology with a view to obtaining the degree of Master of Science or Doctor of Philosophy should secure special training in anatomy, mammalian physiology, organic chemistry, and physical chemistry.

For Graduates and Advanced Undergraduates

Pharmacol. 101, f.s. General Pharmacology. (8)

Three lectures and one laboratory. This course consists of 90 lectures and 30 laboratory periods of three hours each, offered each year. Laboratory fee, \$20.00.
(Krantz, Truitt, Burgison, Musser, Harne.)

For Graduates

Pharmacol. 201, f.s. General Pharmacology. (8)

Same as Pharmacol. 101, for students majoring in pharmacology. Additional instruction and collateral reading are required. Laboratory fee, \$20.00.
(Krantz, Truitt, Burgison.)

Pharmacol. 206, f.s. Pharmacologic Methodology. (4)

Prerequisite, Pharmacol. 201, f.s. (Truitt.)

Pharmacol. 207, 208. Chemical Aspects of Pharmacodynamics. (2, 2)

(Burgison.)

Pharmacol. 399. Research.

Maximum credits, 12. Credit in accordance with the amount of work accomplished.
(Krantz, Truitt, Burgison.)

PHYSIOLOGY

Professors: AMBERSON, FERGUSON AND SMITH.

Associate Professor: WHITE.

Lecturers: ANDERSON, BROWN, WILBER AND WILLS.

Interdepartmental Courses

The Department of Physiology prefers to accept students who have already had some graduate training elsewhere. Before admission to candidacy for the Doctor of Philosophy degree the Department gives a qualifying examination, both oral and written, which must be satisfactorily passed.

In the usual case a student majoring in physiology will be expected to take *Physiol. 101* before, or concurrently with, courses 201 to 206 below. Such a student will extend his program by taking courses in other departments of this University, and by enrolling in the summer course in physiology at the Marine Biological Laboratory, Woods Hole, Massachusetts.

For Graduates and Advanced Undergraduates

Physiol. 101. The Principles of Physiology. (9)

Second semester. Five lectures, two conferences and two 4-hour laboratory periods per week for 16 weeks. Laboratory fee, \$15.00. The lectures cover the major fields of physiology, including the following areas: central and peripheral nervous systems, neuro-muscular apparatus, heart and circulation, respiration, kidney and body fluids, gastrointestinal tract, endocrines and reproduction. The laboratory includes experiments with frog and turtle heart and nerve-muscle preparations, mammalian operative work and observations on the human subject. (Amberson, Staff.)

For Graduates

Physiol. 201. Experimental Mammalian Physiology.

Time and credit by arrangement. This course permits further experience in mammalian operative work. (Amberson, Staff.)

Physiol. 202. Blood and Tissue Proteins. (2)

Two hours a week, lectures, seminars and conferences for 15 weeks. Consideration will be given to the physical, chemical and physiological properties of the proteins of blood and body tissues. (White.)

Physiol. 204. Physiological Techniques.

Time and credit by arrangement. The various technical procedures currently operating in the Department will be demonstrated and opportunity will be given for acquiring experience with them. (Amberson, Staff.)

Physiol. 205. Physiology of Kidney and Body Fluids. (2)

Two hours a week, lectures, seminars and conferences, for 15 weeks. Consideration will be given to the current status of knowledge of renal function and body fluids in vertebrates, with particular reference to mammals. (Ferguson.)

Physiol. 206. Seminar.

Credit according to work done. Weekly meetings are held to discuss recent literature and results of departmental research. (Staff.)

Physiol. 399. Research.

By arrangement with Head of the Department. (Staff.)

SCHOOL OF NURSING

PSYCHIATRIC NURSING, MATERNAL AND CHILD HEALTH AND MEDICAL-SURGICAL NURSING

Professors: CARL, GIFE AND GRENELL.

The School of Nursing of the University is one of the six schools in the South selected for membership in the Southern Regional Education Board.

OBJECTIVE OF THE GRADUATE PROGRAM

The Graduate Program in Nursing leading toward the degree of Master of Science in Nursing is designed primarily to prepare registered nurses in the area of psychiatric nursing, and maternal and child nursing as teachers, supervisors and administrators or clinical specialists; and medical and surgical nursing as teachers, supervisors and administrators.

ADMISSION

Admission to the graduate program in nursing, requires the applicant to be a registered nurse who has completed an undergraduate degree with academic standing which is recognized by the Graduate School of the University of Maryland. In addition, the applicant must have clinical experience in medical and surgical nursing, psychiatric nursing, maternal and child nursing, and public health nursing including field practice in an approved agency comparable to the requirements in the basic undergraduate nursing program of the University of Maryland. The applicant must demonstrate competence in the clinical areas through the National League for Nursing Graduate Nurse Qualifying Examination. If the applicant does not demonstrate competence necessary additional work and practice must be taken on the bachelor's level.

CURRICULUM REQUIREMENTS

Requirements for the Master of Science degree include the satisfactory completion of at least thirty semester hours of graduate work. The thirty hour program includes twenty-four hours of course work and six semester hours for the thesis. At least twelve semester hours must be taken in the major field, and at least eight semester hours must be taken in the minor field. It is required that at least twelve hours of course work be taken in courses numbered in the catalogue as 200 courses.

THESIS

A thesis representing research in the major field must be approved by the advisor of the student and presented to the Dean of the Graduate School as a

partial requirement for the Master of Science Degree. Final approval of the thesis is given by the examination committee appointed by the Dean of the Graduate School.

LEARNING EXPERIENCES

Through graduate study the student broadens and deepens understandings built first upon knowledge and then greater understanding of a particular specialty of study and work. Having the privilege of studying with graduate students in other disciplines, the graduate student in nursing has opportunities to transfer knowledge from other areas to enrich her understandings in her own field of specialty. The graduate student is given opportunity to learn to pursue, evaluate and apply results of research in nursing in order to find better ways of improving patient care.

The extensive clinical facilities of the University of Maryland provide an excellent climate where this dynamic learning can occur. Seminars, workshops, and institutes also provide opportunities for extending the scope of understanding of the graduate student. Depending upon the functional interest, the student receives practice in teaching or supervision under guidance.

Nurs. 201. Trends of Higher Education in Nursing. (2)

First semester. One lecture and two hour conferences a week. The central objective of this course is to bring to the student in nursing education a knowledge and an understanding of the current status of nursing in institutions of higher learning and what nursing must have as a goal before it can become a universally accepted profession. (Gipe, Staff.)

Nurs. 202. Interpersonal Interaction. (2)

First semester. One lecture and one two-hour laboratory period a week. The course is primarily concerned with the application of psychodynamics and psychoanalytic understandings to the nurse's relationships with patients. (Staff.)

Nurs. 203. Nursing in the Somatic Therapies. (2)

First semester. One lecture and one two-hour laboratory period a week. The course is planned to assist the graduate student to broaden her ability to apply biological, physiological and somatic therapies of behavior to the care of psychiatric patients. Through this course the student may become aware of current research determining the causative factors of behavior, therefore, she may have an opportunity to formulate the effects of newer somatic methods of treatment upon her role in the care of psychiatric patients. (Carl and others.)

Nurs. 204, 205. Psychiatric Nursing. (2, 2)

First and second semesters. One lecture and two four-hour laboratory periods a week. The course includes dynamics of human behavior, including formation of personality, the techniques of problem solving and the skills of communication as preparation for administering expert therapeutic nursing care to psychiatric patients. (Staff.)

Nurs. 206. Philosophical Concepts in Health. (2)

Second semester. Two hour lecture a week. The course is planned with a contemporary approach to the problem of philosophical concepts in health. The discussions begin with general considerations and progress to the application of these concepts to more specific situations. (Chelsky.)

Nurs. 207, 208. Nursing in Child Health Services. (2, 2)

First and second semesters. One lecture and two four-hour laboratory periods a week. The course is concerned with deeper knowledge of the place of nursing in the society's total program of child health services and increased skill in the nursing of children. (Staff.)

Nurs. 209, 210. Nursing in Maternal and Newborn Services. (2, 2)

First and second semesters. One lecture and two four-hour laboratory periods a week. The course is concerned with knowledge of obstetrics and the opportunity to apply this knowledge in varying nursing situations as it relates to the patient, to the family and to the community. (Hydorn.)

Nurs. 211. Seminar in Maternal and Child Health Services. (2)

Second semester. One two-hour period a week. The course is concerned with understanding and purposeful application of maternal and child health nursing as it normally exists within the family. The influence of the nurse on maternal and child health is traced through the many institutions and agencies where she contacts the mother and child, or the family as a whole. (Hydorn and others.)

Nurs. 212, 213. Medical-Surgical Nursing. (2, 2)

First and second semester. One lecture and two four-hour laboratory periods a week. The course is designed to meet the needs of students who are interested in developing the broader and deeper aspects of nursing care as it relates to the analyzing of those elements in the art and science of nursing which take the learner beyond the realm of general practice of nursing. (Hosfeld.)

Nurs. 214. Application of Principles of Physical and Social Sciences in Nursing. (2)

First semester. One lecture and one two-hour laboratory period a week. The course is designed to apply physical and social science principles in a life situation in such a way that similar situations will be recognized by the learners in their day to day application. (Zitkus.)

Nurs. 286. Research Methods and Materials in Nursing. (2)

First semester. One two-hour lecture or conference period a week. The course deals with basic understandings of philosophical aspects as they relate to research, including the nature of scientific thinking; with the basic methodologies of research; with participation in research activities; and understanding of research literature in nursing. (Carl.)

Nurs. 287. Seminar in Nursing. (2)

Second semester. One two-hour lecture or conference period a week. (Staff.)

Nurs. 399. Research—Thesis. (1-6)

SCHOOL OF PHARMACY

Professors: FOSS, ESTABROOK, ICHNIOWSKI, PURDUM, RICHESON, SHAY AND SLAMA.

Associate Professors: ALLEN AND MILLER.

Assistant Professor: DOORENBOS.

BIOCHEMISTRY

For Graduates and Advanced Undergraduates

Chem. 153. Biochemistry. (5)

First semester. Four lectures and conferences and one four-hour laboratory period a week. Prerequisites, Chem. 35, 36, 37, 38, 15. (Staff.)

PHARMACOGNOSY

For Graduates and Advanced Undergraduates

Pharmacognosy 101, 102. Taxonomy of the Higher Plants. (2, 2)

Given in alternate years. One lecture and one laboratory. Prerequisite, Pharmacognosy 51, 52. A study of the kinds of seed plants and ferns, their classifications, and field work on local flora. Instruction will be given in the preparation of an herbarium. (Slama.)

Pharmacognosy 111, 112. Plant Anatomy. (4, 4)

Two lectures and two laboratories. Prerequisites, Pharmacognosy 51, 52. Lectures and laboratory work covering advanced plant anatomy with special emphasis placed on the structure of roots, stems and leaves of vascular plants. (Slama.)

For Graduates

Pharmacognosy 201, 202. Advanced Study of Vegetable Powders. (4, 4)

Given in alternate years. Two lectures and two laboratories. Prerequisites, Pharmacognosy 111, 112. A study of powdered vegetable drugs and spices from the structural and microchemical standpoints, including practice in identification and detection of adulterants. (Slama.)

Pharmacognosy 211, 212. Advanced Pharmacognosy. (4, 4)

Two lectures and two laboratories. Prerequisites, Pharmacognosy 111, 112. A study of many crude drugs not ordinarily studied in other pharmacognosy courses. Special attention will be given to practical problems and to the identification and detection of adulterants. (Slama.)

Pharmacognosy 399. Research in Pharmacognosy.

Credit according to the amount and quality of work performed. (Slama.)

MATHEMATICS

*For Graduates and Advanced Undergraduates**Math. 152, 153. Mathematical Statistics. (2, 2)*

Given in alternate years. Prerequisites, Math. 20, 21. Frequency distributions and their parameters, multivariate analysis and correlation, theory of sampling, analysis of variance, statistical inference. Illustrations will be drawn from the biological sciences. (Richeson.)

MICROBIOLOGY

*For Graduates and Advanced Undergraduates**Microb. 115. Serology and Immunology. (4)*

Second semester. Two lectures and two laboratory periods a week. Protective reactions of the animal body against pathogenic microorganisms and their products; cellular and humoral immunity; anaphylaxis and allergies. (Shay.)

*For Graduates**Microb. 200, 201. Chemotherapy. (1, 1)*

Alternate years. Prerequisites, Microbiology 121 or equivalent, Biochemistry 111 or equivalent. Lectures which deal with the chemistry, toxicity, pharmacology and therapeutic value of drugs employed in the treatment of disease. (Shay.)

Microb. 202, 203. Reagents and Media. (1, 1)

Offered in alternate years. Consideration of media for special procedures such as antibiotic assays, blood cultures, spinal fluid, exudates and other materials. Anaerobiosis, differential media, biochemical reactions, sensitivity and sterility testing are considered in detail. Emphasis is placed on growth requirements of specific groups of microorganisms. (Shay.)

Microb. 210. Special Problems in Microbiology.

Laboratory course. Special studies in the various divisions of microbiology. Credit determined by amount and quality of work performed. (Shay.)

Microb. 211. Public Health. (2)

Prerequisite, Microb. 121 or equivalent. A demonstration of public health facilities in the community and their relation to the practices of the health sciences carried on through lectures and discussion groups. The application of statistical and epidemiological methods to health problems is illustrated through lectures and demonstration. (Shay.)

Microb. 221. Research in Microbiology.

Credit determined by amount and quality of work performed. Open only to candidates for advanced degrees in microbiology. (Shay.)

Microb. 399. Thesis Research.

(Shay.)

PHARMACEUTICAL CHEMISTRY

*For Graduates and Advanced Undergraduates**Chem. 101. Advanced Inorganic Chemistry. (2)*

The principles of inorganic chemistry at an advanced level—nuclear and atomic structure, bonding, complexions and coordination compounds, oxidation and reduction, acids and bases; the descriptive chemistry of the elements. (Doorenbos.)

Pharm. Chem. 111, 113. Chemistry of Medicinal Products. (3, 3)

A study of the synthesis of the structural relationships, and of the physical and chemical properties of medicinal products. (Doorenbos.)

Pharm. Chem. 112, 114. Chemistry of Medicinal Products. (2, 2)

Laboratory exercises dealing with important and characteristic chemical properties of pharmaceutical and medicinal products. (Doorenbos.)

Chem. 141, 143. Advanced Organic Chemistry. (2, 2)

The advance theory and descriptive chemistry of organic compounds with more emphasis on theoretical concepts. (Miller.)

Chem. 142, 144. Advanced Organic Laboratory. (2, 2)

The more difficult preparations of organic compounds. (Miller.)

Chem. 146, 148. Identification of Organic Compounds. (2, 2)

The systematic identification of organic compounds, both individual and mixtures. (Miller.)

*For Graduates**Pharm. Chem. 201, 203. Survey of Pharmaceutical Chemistry. (2, 2)*

A study of the basic chemistry and stereochemistry of cyclic compounds including the chemistry of terpenes and steroids. (Miller, Doorenbos.)

Pharm. Chem. 211, 213. Chemistry of Alkaloids. (2, 2)

A study of the basic chemistry of amines, heterocyclic compounds, and alkaloids. (Doorenbos.)

Pharm. Chem. 220. Advanced Pharmaceutical Synthesis. (2-6)

Application of synthetic procedures in the preparation of various medicinal chemicals and their intermediates. (Miller, Doorenbos.)

Pharm. Chem. 222. Advanced Pharmaceutical Analysis. (1-4)

A laboratory study of the analytical procedures and methods as applied to official, proprietary, natural and synthetic drugs, their intermediates and derivatives. (Doorenbos.)

Pharm. Chem. 230. Pharmaceutical Chemistry Seminar. (1)

Reports of progress and survey of recent developments in pharmaceutical chemistry. (Miller, Doorenbos.)

Pharm. Chem. 258. *The Identification of Organic Compounds, An Advanced Course.* (2-4)

The techniques of identification of more difficult compounds, with emphasis on instrumental methods. (Miller.)

Pharm. Chem. 399. *Research in Pharmaceutical Chemistry.*

(Miller, Doorenbos.)

PHARMACOLOGY

For Graduates and Advanced Undergraduates

Pharmacology 111. *Official Methods of Biological Assay.* (4)

First semester. Two lectures and two laboratory periods a week. Prerequisite, Pharmacology 81, 82. A study of the official methods of biological assay of the United States Pharmacopoeia and the National Formulary. (Ichniowski.)

For Graduates

Pharmacology 201, 202. *Methods of Biological Assay.* (4, 4)

First semester. Two lectures and two laboratory periods a week. Prerequisites, 111. A study of the more important unofficial methods used in the quantitative evaluation of therapeutic substances. (Ichniowski.)

Pharmacology 211, 212. *Special Studies in Pharmacodynamics.* (4, 4)

First and second semesters. Laboratory and conferences. Prerequisites, Pharmacology 81, 82 and the approval of the instructor. Offered in alternate years. A study of the methods used in the evaluation of drug action. (Ichniowski.)

Pharmacology 221, 222. *Special Studies in Biological Assay Methods.* (2-4, 2-4)

Credit according to the amount of work undertaken after consultation with the instructor. First and second semesters. Laboratory and conferences. Prerequisites, Pharmacology 111, 201, 202. Special problems in the development of biological assay methods. (Ichniowski.)

Pharmacology 399. *Research in Pharmacology.*

Properly qualified students may arrange with the instructor for credit and hours. (Ichniowski.)

PHARMACY

For Graduates and Advanced Undergraduates

Pharmacy 101, 102. *Advanced Dispensing Pharmacy.* (3, 3)

Senior year, two lectures and one laboratory. Prerequisites, Pharmacy 21, 22, 51, 52. A study of the compounding of new medicinal ingredients and dispensing aids used in modern professional pharmacy, including the preparation of some important classes of pharmaceuticals on a commercial scale. (Allen.)

Pharmacy

Pharmacy 121. *Hospital Pharmacy Administration.* (2)

First semester. Senior year. Two lectures. A study of hospital pharmacy practice and administration. (Purdum.)

Pharmacy 132. *Cosmetics.* (3)

Second semester. Senior year. Two lectures and one laboratory. Prerequisites, Pharmacy 21, 22, 51, 52, and 101. A study of the composition and manufacture of cosmetic preparations including laboratory work in the formulation of these products. (Allen.)

For Graduates

Pharmacy 201, 202. *Manufacturing Pharmacy.* (2, 2)

Given in alternate years. Two lectures. Prerequisites, Pharmacy 101, 102, 132. A study of manufacturing processes and equipment employed in the manufacture of pharmaceuticals on a commercial scale. (Foss.)

Pharmacy 203, 204. *Manufacturing Pharmacy.* (2, 2)

Two laboratories. Prerequisites, Pharmacy 201, 202, or may be taken simultaneously with Pharmacy 201, 202. Laboratory work dealing with the preparation of useful and important pharmaceuticals in large quantities. (Foss.)

Pharmacy 205. *Manufacturing Pharmacy Control.* (3)

Given in alternate years. Three lectures. A study of the specifications, inspection, sampling, packaging and labeling of drugs from their receipt to their shipping by pharmaceutical manufacturing plants. Includes detailed consideration of sanitary standards, the Federal Food, Drug and Cosmetic Act, and other laws affecting the production and distribution of pharmaceutical products. (Foss.)

Pharmacy 207, 208. *Physical Pharmacy.* (2, 2)

Two lectures a week. Prerequisites, Physical Chemistry 187, 188, 189, 190. A study of pharmaceutical systems utilizing the fundamentals of physical chemistry. (Staff.)

Pharmacy 211, 212. *Survey of Pharmaceutical Literature.* (1, 1)

Given in alternate years. One lecture. Lectures and topics on the literature pertaining to pharmacy, with special reference to the origin and development of the works of drug standards and the pharmaceutical periodicals. (Allen, Purdum.)

Pharmacy 215, 216. *Product Development.* (2, 2)

Two laboratories. Prerequisites, Pharmacy 132, 201, 202, 203, 204. A study of the development of new pharmaceutical preparations and cosmetics suitable for marketing. (Allen.)

Pharmacy 221, 222. *History of Pharmacy.* (2, 2)

Given in alternate years. Two lectures. Lectures and assignments on the development of pharmacy in America and the principal countries of Europe. (Purdum.)

Pharmacy 230. *Pharmaceutical Seminar.* (1)

Each semester. Required of students majoring in pharmacy. Reports of progress in research and surveys of recent developments in pharmacy. (Foss, Allen.)

Pharmacy 231, 232. Special Problems in Pharmaceutical Technology. (2, 2)
Two laboratories. A study of technical problems in the stabilization and preservation of pharmaceuticals and the various methods of compounding special prescriptions.
(Allen, Purdum.)

Pharmacy 399. Research in Pharmacy.

Credit and hours to be arranged.

(Foss, Purdum, Allen.)

PHYSICS AND PHYSICAL CHEMISTRY

For Graduates and Advanced Undergraduates

Chem. 187, 189. Physical Chemistry. (3, 3)

First and second semesters. Three lectures per week. Given in alternate years. Prerequisites, Phys. 11, Chem. 15, 37, Math. 21. A study of the laws of chemistry, including the gas laws, kinetic theory, liquids, solutions, elementary thermodynamics, thermo chemistry, equilibrium, chemical kinetics, and electro-chemistry. (Estabrook.)

Chem. 188, 190. Physical Chemistry. (2, 2)

First and second semesters. Two laboratory periods per week. Prerequisites, Chem. 187, 189, or may be taken simultaneously with these courses. Quantitative experiments are performed which demonstrate physical chemical principles, and acquaint the student with precision apparatus. (Estabrook.)

Phys. 104, 105. Electricity and Magnetism. (3, 3)

First and second semesters. Two lectures and one laboratory period per week. Given according to demand. Prerequisites, Phys. 11 and Math. 21. A study of the fundamental laws of magnetism, electrostatics, and current electricity. Selected experiments are performed illustrating these principles. (Estabrook.)

Phys. 112, 113. Modern Physics. (2, 2)

First and second semesters. Two lectures per week. Prerequisites, Chem. 189, 190, Phys. 10, 11. Given according to demand. A descriptive study of the nature of matter and radiation. Conduction of electricity, and ionization in gases, thermionics, x-rays, radioactivity, nuclear physics, and cosmic rays will be considered. (Estabrook.)

For Graduates

Phys. 200, 201. Introduction to Theoretical Physics. (5, 5)

First and second semesters. Five lectures per week. Given according to demand. Prerequisite, advanced standing in physics. A study of the fundamentals in physics from a mathematical standpoint. (Estabrook.)

Phys. 208, 209. Thermodynamics. (2, 2)

First and second semesters. Two lectures per week. Prerequisite, Phys. Chem. 188, 190. Given in alternate years. A study of the laws of thermodynamics from a mathematical and statistical standpoint. Numerous problems are solved. (Estabrook.)

THE GRADUATE COUNCIL

Ex-Officio Members

- WILSON H. ELKINS, D.PHIL., *President of the University*
 HARRY C. BYRD, LL.D., D.SC., *President Emeritus*
 R. LEE HORNBAKE, PH.D., *Dean of the Faculty*
 RONALD BAMFORD, PH.D., *Dean of the Graduate School*
 CHARLES O. APPLEMAN, PH.D., *Dean Emeritus*
 AUGUSTUS J. PRAHL, PH.D., *Associate Dean and Secretary of the Graduate Faculty Assembly*

Appointed Members

*Term
Expires*

- NOEL E. FOSS, PH.D., *Professor of Pharmacy (Baltimore)*..... 1962
 FREDERIC T. MAVIS, PH.D., *Professor of Civil Engineering*..... 1961
 MICHAEL J. PELCZAR, PH.D., *Professor of Microbiology*..... 1960
 LEON P. SMITH, PH.D., *Professor of Foreign Languages*..... 1959

Elected Members

- FRANKLIN D. COOLEY, PH.D., *Associate Professor of English*..... 1961
 DUDLEY DILLARD, PH.D., *Professor of Economics*..... 1960
 NATHAN L. DRAKE, PH.D., *Professor of Chemistry*..... 1961
 FREDERICK P. FERGUSON, PH.D., *Professor of Physiology (Baltimore)*.. 1962
 HUGH G. GAUCH, PH.D., *Professor of Botany*..... 1961
 IRVING C. HAUT, PH.D., *Professor of Horticulture*..... 1960
 MONROE H. MARTIN, PH.D., *Professor of Mathematics*..... 1962
 BENJAMIN H. MASSEY, PH.D., *Professor of Physical Education*..... 1961
 ROBERT H. OSTER, PH.D., *Professor of Physiology (Baltimore)*..... 1960
 ELMER PLISCHKE, PH.D., *Professor of Government and Politics*..... 1959
 HENRY R. REED, PH.D., *Professor of Electrical Engineering*..... 1959
 CLYNE S. SHAFFNER, PH.D., *Professor of Poultry Physiology*..... 1962
 GLADYS WIGGIN, PH.D., *Professor of Education*..... 1959

GRADUATE FACULTY

1959-1960

GRADUATE SCHOOL

Administrative Officers

RONALD BAMFORD, *Professor of Botany and Dean of the Graduate School*

B.S., University of Connecticut, 1924; M.S., University of Vermont, 1926; PH.D., Columbia University, 1931.

AUGUSTUS J. PRAHL, *Professor of Foreign Languages and Associate Dean of the Graduate School*

M.A., Washington University, 1928; PH.D., Johns Hopkins University, 1933.

LUCY A. LYNHAM, *Assistant to the Dean*

B.A., University of Maryland, 1933.

Professors

MYRON S. AISENBERG, *Professor of General and Oral Pathology and Dean of School of Dentistry*

D.D.S., University of Maryland, 1922.

ALFRED O. ALDRIDGE, *Professor of English*

B.S., Indiana University, 1937; M.A., University of Georgia, 1938; PH.D., Duke University, 1942; Docteur de l'Université de Paris, 1955.

RUSSELL B. ALLEN, *Professor of Civil Engineering and Assistant Dean of College of Engineering*

B.S., Yale University, 1923.

WILLIAM R. AMBERSON, *Professor and Head of Department of Physiology, School of Medicine*

PH.B., Lafayette College, 1915; PH.D., Princeton University, 1922.

GEORGE ANASTOS, *Professor of Zoology*

B.S., University of Akron, 1942; M.A., Harvard University, 1947; PH.D., 1949.

VERNON E. ANDERSON, *Professor and Dean of the College of Education*

B.S., University of Minnesota, 1930; M.A., 1936; PH.D., University of Colorado, 1942.

THOMAS G. ANDREWS, *Professor and Head of Department of Psychology*

B.A., University of Southern California, 1937; M.A., University of Nebraska, 1939; PH.D., 1941.

WENDELL S. ARBUCKLE, *Professor of Dairy*

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—The University is the rear guard and the advance agent of society. It lives in the past, the present and the future. It is the storehouse of knowledge; it draws upon this depository to throw light upon the present; it prepares people to live and make a living in the world of today; and it should take the lead in expanding the intellectual horizons and the scientific frontiers, thus helping mankind to go forward —always toward the promise of a better tomorrow.

—From "The State and the University,"
the inaugural address of
President Wilson H. Elkins,
January 20, 1955,
College Park, Maryland.

